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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

30161 (DRCL-371) SURFACE BURST OF 100 TON TNT HEMISPHERICAL CHARGE (1961) PROJECT NO. 4 THERMAL MEASUREMENTS. P. A. Tate and J. D. R. Pattmann (Canada. Defence Research Chemical Labs., Ottawa). June 1962. 34p.

The radiant flux from an exploding charge of 100 tons of TNT was recorded in selected color bands using high speed bolometers and photocells with appropriate filters. Thermoelectric calorimeters were used to measure the total radiant energy emitted. The heat pulse exhibited an initial maximum of radiant intensity followed by a minimum at about 2 ms after detonation and a second maximum at about 20 ms. Surface temperatures of the fireball were calculated from the observed spectral distribution of energy. The maximum temperature of the shock front was about 10,000°K and was reached less than 1 ms after detonation. The temperature decreased until at late times it was 2500°K characteristic of burning detonation products. There was no minimum of temperature. Two different types of instruments viewing different sides of the fireball gave the thermal yield as 3.8% and 6.6% of the total energy yield of the explosion. (auth)

30162 (IA-726) RESEARCH LABORATORIES SEMI-ANNUAL REPORT FOR THE PERIOD JULY–DECEMBER 1961. (Israel. Atomic Energy Commission, Tel-Aviv). 132p.

Summaries are presented of the research work carried out during the period July to December 1961 on the reactor IRR-I, nuclear instrumentation, physics, chemistry, biology and medicine, health physics and fallout studies, and documentation. (M.C.G.)

30163 (NP-12002) LITERATURHINWEISE ZU RECHTS- UND WIRTSCHAFTSFRAGEN DER ATOMENERGIE. (Literature References on Legal and Economic Questions of Atomic Energy). (Kernforschungsanlage, Jülich, Germany). July 15, 1962. 39p.

One hundred and ninety-three references on legal and economic questions of atomic energy are presented. They are arranged by author under the following topics: general, introductory papers, general law, law of atomic energy, general economics, atomic economics, social problems and atomic politics, periodicals, sessions and conferences, and parliaments' printed materials and minutes. (M.C.G.)

30164 (NP-12008) SURFACE BURST OF 100 TON TNT HEMISPHERICAL CHARGE. THE BEHAVIOUR OF ARMY WOOD LINE CONSTRUCTION POLES EXPOSED TO BLAST LOADING. Suffield Technical Note No. 70. H. T. Beare (Canada. Suffield Experimental Station, Ralston, Alberta). June 15, 1962. 17p.

The effects of a blast wave from a 100-ton charge of TNT on army communication pole lines were studied. Each pole line consisted of three Canadian Army wood line-construction poles and the necessary standard rope guys and wire. The pole lines were placed in the region of predicted incident overpressure of from 25 psi to 2 psi. The line at the 2 psi level and two poles of the line at the 5 psi level remained standing after the explosion. A discussion on a possible design procedure for poles under dynamic loading is included. (auth)

30165 (ORNL-3313) METALS AND CERAMICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING MAY 31, 1962. (Oak Ridge National Lab., Tenn.). Aug. 16, 1962. Contract W-7405-eng-26. 227p.

Sections are included on reactor project activities, materials properties, metal and ceramic fabrication, applied research, and fundamental research. Separate abstracts were prepared for each section. (J.R.D.)

30166 (ORNL-3313(p.1-18)) PART I. REACTOR PROJECT ACTIVITIES. P. Patriarca (Oak Ridge National Lab., Tenn.).

Efforts at ORNL in support of the overall gas-cooled reactor program consist of EGCR construction support, experimental studies aimed at reducing fuel cycle costs associated with EGCR and GCR-3, advanced gas-cooled power reactor development, and development of unclad ceramic fuel elements for service in the Pebble-bed Reactor Experiment. In the Molten Salt Reactor program, procurement of all INOR-8 components required in the MSRE was completed except for the heat exchanger. Data were obtained concerning properties and fabrication of this alloy. Specifications for a salt-permeation-resisting graphite-moderator were prepared. Design work in the High Flux Isotope Reactor (HFIR) is reviewed. An unfueled element assembled to very close tolerances was fabricated for flow testing in the HFIR program. In the transuranium program, prototype fuel pellets containing simulated actinide oxides mixed with Al were produced in a study of the required technology for fabrication of the HFIR target rods in the Transuranium Processing Plant (TRU). Conceptual design and layout in the three fabrication cubicles of the TRU were accomplished for virtually all of the target-rod fabrication equipment. Developments in the thermonuclear project were concerned mostly with the DCX-1 and -2, and with vacuum technology. In the thorium utilization program, efforts were devoted to development of a process by which metal-clad fuel rods can be remotely fabricated with relative ease. The method selected for study involves compacting coarse, dense fuel

particles of ThO_2-UO_2 with vibrational energy. Densities of 88% of theoretical value were obtained using pneumatic equipment. More sophisticated equipment is being developed. Construction and development of the Advanced Test Reactor is described. Work in support of the Army Power Reactor Program was directed toward advancing the technology of UO_2–stainless steel dispersion fuels. The initial core loading for the SM-1 was fabricated. Work in the Maritime program was devoted to evaluation of nonsintered bulk UO_2 fuel rods for use in the Savannah. The materials assistance to the Enrico Fermi Reactor program is concerned with improved fuel elements for future operation. The proposed elements for Core B are described along with results of fuel bundle studies and the development of nondestructive testing methods. (J.R.D.)

30167 (ORNL-3313(p.19-64)) PART II. MATERIALS PROPERTIES. D. A. Douglas, Jr. (Oak Ridge National Lab., Tenn.).

Corrosion Engineering. Loop and capsule experiments were performed to investigate the nature of reactions occurring between contaminated He and construction materials used in high-temperature gas-cooled reactors. Exposures of type 304 stainless steel in static He containing impurities desorbed from graphite produced both Fe and Cr oxidation products, the relative proportions depending on the $CO:CO_2$ ratios of the gas mixtures. Carburization of type 304 stainless steel occurred in all graphite-containing tests when the exposure temperatures were above 815°C. The presence of small quantities of CO_2 in these tests effected relatively heavy oxidation of low-alloy steels at 593°C. Compatibility problems arising from the juxtaposition of graphite and type 304 stainless steel surfaces were evaluated as a function of surface temperature and contact pressure. Diffusion couples of these materials became securely bonded during anneals at 650 and 750°C, and partial bonding occurred at anneals as low as 600°C. Carbide precipitation at stainless steel surfaces was evident only below bonded areas. Copper-plating or preoxidation of stainless steel surfaces effectively suppressed carburization and bonding even at relatively high contact loads (10,000 psi). The corrosion rates of INOR-8 forced-convection systems under prolonged exposures to fluoride salt mixtures were measured as a function of service temperature. Weight losses of corrosion inserts exposed to $LiF-BeF_2-UF_4-ThF_4$ salt mixtures at 700 to 815°C did not increase measurably after 5000 hr and showed a relatively small temperature dependence. However, the nature of attack was noticeably affected by temperature. Corrosion studies were initiated to evaluate the effects of HF and CF_4 on the attack of INOR-8 by fluoride salt mixtures. Additions of HF to INOR-8 loops containing the mixture $NaF-ZrF_4$ promoted rapid oxidation of Ni and the precipitation of NiF_2. Exposure of INOR-8 to CF_4 vapor resulted in little attack up to 800°C; however, type 304 stainless steel, Mo, and Inconel specimens were heavily attacked under the same conditions. Fuels Evaluation. Neutron-activation techniques were used to study the fission-product-retention characteristics of graphite elements containing UC_2 particles coated with pyrolytic carbon. When tested as unsupported particles, three types of coatings–laminar, columnar, and duplex–released on the order of 10^{-4} % of the Xe^{133} during postirradiation heating for 24 hr at temperatures below 1800°C. Duplicate batches of coated particles that had been fabricated into graphite fuel elements generally had release rates about 100 times higher, presumably as a result of coating rupture during fabrication or U migration through the coatings. The Xe-retention characteristics of a few elements were as good as those of the unsupported particles contained therein. These data led to the conclusion that satisfactory fuel elements can be fabricated with careful and proper techniques. Release rate data on fission products other than Xe indicated that the metallic species Ba, Sr, and Ag migrate through the coatings more rapidly than does Xe. Tests then made to confirm the suspicion that U might also migrate through the coatings showed that U migrates through 100-μ-thick laminar coatings in 20 hr at 1700°C. Materials Compatibility. Selection of container materials compatible with alkali metals at elevated temperatures has been a continuing research program for several years. One area that received attention during the past year was an evaluation of methods for removing impurities from alkali metals. The use of metals such as Zr and Ti as getters was found to be the most practical and effective means of reducing the O_2 content. Research was initiated to determine the distribution coefficient of O_2 between potential getter materials and alkali metals. Oxygen contamination of alkali metals was observed to increase the corrosion of many container materials. In evaluating the accuracy of the existing analytical techniques for determining O_2 in the alkali metals, none of the analytical methods investigated gave satisfactory results. Therefore a program was initiated to develop a method for determining the O_2 content of K. An investigation of the effect of O_2 concentration of refractory metals on their corrosion resistance to Li at elevated temperatures showed the pure metals Nb, Ta, V, and Zr to exhibit excellent resistance at temperatures even in excess of 800°C. When small quantities of O_2 were added to either Nb or Ta, Li penetrated these metals very rapidly over a wide range of temperatures. No attack was observed when V and Zr were contaminated with O to levels of 2000 and 4000 ppm, respectively. A sample of grade CGB-X graphite was examined as part of the MSRE evaluation tests. Salt permeation tended to be restricted to a shallow penetration (less than 0.01 in.) below the external surface of the graphite with the salt pressure approximately three times that expected in the MSRE. Tests on ten grades of graphite having porosities ranging from low to high indicated that a simple Hg-impregnation test at room temperature is suitable for quality control for various grades of graphite and can be related to molten fluoride salt permeation. Twenty-hour-long purges with the thermal decomposition products of crystals of $NH_4F \cdot HF$ in the range 200 to 705°C indicated that O_2 contamination can be removed from moderately permeable grades of graphite. During such purges, a slight reaction will occur between the $NH_4F \cdot HF$ and INOR-8. Mechanical Properties. The experimental work of this group was related to those areas in which significant problems exist in the various reactors under development at the Laboratory. Long-range research included studies of the effects of carburization in CO_2 on the properties of stainless steels, of the effect of a hydrogen environment on creep and fracture of Ni-base alloys, and of means for solving deformation and fracture problems. The strength and strain-fatigue properties of UO_2–stainless steel dispersion fuel plate developed for the Enrico Fermi Reactor core B were found to be consistent with what would be expected qualitatively for such a dispersion. The ductility of the plate in the transverse direction, however, was somewhat low. The creep and tensile properties of the fuel plate and cladding materials for the Advanced Test Reactor were investigated in the range 400 to 600°F. Aluminum alloys 6061-0 and X8001 in the annealed and cold-worked conditions were investigated. A thorough evaluation of the properties of the EGCR fuel element under thermal-cycling conditions was completed and

was begun for Be cladding and for type 304 stainless steel cladding having thicknesses smaller than the 0.020 in. planned for the EGCR. The brittleness of Be at low temperatures caused the finned Be tubing to fail under thermal cycling. The problems with thin stainless steel cladding are associated with the manner in which the tubes collapse onto the UO_2 under external pressure. The instantaneous collapse at elevated temperatures of type 304 stainless steel tubes under external pressure and the effects of tube ovality and wall-thickness variation were studied experimentally. The predictions of applied mechanical theories based on the stress-strain characteristics of the material correlated well with the experimental data. The ovality of the tubes was found to affect the critical pressure more significantly than did the variations in wall thickness, as was predicted by theory. The stress-rupture properties of type 304 stainless steel and an Nb–1% Zr alloy were investigated in the useful temperature range for each material. Analysis of the data for type 304 stainless steel indicated that the stress-rupture properties may be successfully correlated by using the Dorn parameter. The irradiation effects and mechanical properties of Be continued to be investigated. In-pile stress-rupture experiments at 520°C indicated the effect of irradiation on the stress-rupture strength to be small at this temperature. The room-temperature ductility of unirradiated Be tubing in the transverse direction was low; of the order of 0.2 to 0.3%. The distribution of C in Be after exposure to CO_2 was investigated to aid in the interpretation of corrosion phenomena in the material. With a C^{14} tracer technique, the C appeared to be concentrated in the surface reaction layer at temperatures between 600 and 800°C. Study of the carburization of Fe–Ni–Cr alloys and type 304 stainless steel in CO_2 and its effects on the mechanical properties was continued. The Cr content of the alloys appears to be a major factor in determining the magnitude of carburization that occurs. The initial condition of the steel was found to be a significant factor in the effects of carburization on the strength and ductility. Cold working prior to carburization produces greater effects than those noted in annealed material. The effect of a H_2 environment on the creep and rupture properties of Ni-base alloys was investigated in detail. Several possible mechanisms of the observed weakening of these alloys at elevated temperatures in H_2 were studied and some found to be unimportant to the effects observed. In an internal-friction study of the aging reactions involving O_2 and N_2 in Nb–1% Zr alloys, clustering of O_2 near Zr atoms prevailed even at annealing temperatures as high as 1925°C and both O_2 and N_2 precipitated at the aging temperatures. An experimental technique was devised for evaluating the creep and stress-rupture properties of metallurgically stable alloys by use of a steadily increasing stress to fracture the material. The theoretical basis for correlating the results of such experiments with standard creep and stress-rupture tests was worked out, and experiments on types 304 and 309 stainless steels and Zircaloy-2 were performed. The correlation was good for the stress-rupture results for the stainless steels but not very satisfactory for the creep data. Interesting results were observed for Zircaloy-2 in that the strain-aging phenomenon in the alloy could be precisely evaluated at temperatures around 500°C. Some deformation characteristics of Zircaloy-2 tubing at elevated temperatures under biaxial stress states were studied experimentally and related to analytical models developed for isotropic materials. Nondestructive Test Development. Considerable effort was spent in developing new and adequate techniques for the various testing problems posed by nuclear technology, including studies on the use of ultrasonics, electromagnetics, and penetrating radiation. Most of the ultrasonic development work involved behavior in thin sections so that this technique could be applied to the detection of nonbonding in cladding structures. Through-transmission techniques were used for detection of nonbonding in flat fuel plates containing cores of UO_2–stainless steel dispersions, U–Al alloys, and UO_2 or U_3O_8–Al dispersions. Local inhomogeneities were the limiting factors on sensitivity. New and versatile scanning equipment was designed and fabricated for fuel plate inspection development. Lamb-wave and ringing ultrasonic techniques were developed for the evaluation of brazed joints. Electromagnetic or eddy-current studies included the development of prototype instrumentation and techniques for dual-coil, phase-sensitive measurements of thickness in restricted areas. This new system represents a marked improvement since it is relatively insensitive to coil-to-specimen spacing. Continued studies for the development of eddy-current techniques for space gaging included design of probes for a number of reactor fuel cores and extensive experimental studies to provide design criteria relative to coil size and shape and operating frequency. New probes were designed for the measurement of interrod spacing and tubing inner diameter. Studies on low-voltage radiography were made on Al and steel of all applicable thicknesses and on Be up to 2.0 in. thick. A number of charts of exposure techniques, attainable sensitivities, and equivalence factors were prepared as aids to optimum radiography. The low-voltage system was applied to elementary microradiography on coated fuel particles, with viewing up to 500X being made of the finished high-resolution radiographic plates. Excellent detail was observed on many structural variables of the particles and coatings. Development of techniques for the evaluation of fuel homogeneity in rods and plates was begun. For fuel rods Co^{60} gamma rays are passed through the rod, and variations in fuel loading are detected as changes in transmitted beam intensity impinging upon an NaI(Tl) detector. For fuel plates a lower-energy x-ray machine is used as the radiation source. The purpose of this research is to develop appropriate standards and scanning techniques, so that fuel homogeneity can be monitored and recorded quantitatively. Most of the development of nondestructive tests for the evaluation of problem materials was directed toward Mo and finned-Be tubing. The most useful techniques developed for the finned-Be tubing involved low-voltage radiography, bobbin-coil eddy currents, and penetrants; those for Mo tubing involved penetrants, ultrasonics, and eddy currents. Further remote ultrasonic measurements were made with modified mechanical fixtures on the core-vessel wall thickness of the HRT. Another important phase of remote inspection studies was the beginning of technique development for radiography in a radioactive background. Physical Metallurgy. The two general problem areas of alloy stability and surface reactions were studied as related to the Gas-Cooled Reactor, the Enrico Fermi Reactor, the Fast Burst Reactor, and the Molten-Salt Reactor and the development of materials for high-temperature use. The aging reaction, previously discovered in the Nb–1% Zr alloy, was found to be caused by the reduction in O_2 solubility in Nb when Zr is added. The excess O_2 appears as precipitated ZrO_2. It was possible to predict the aging tendencies of a number of different heats of such an alloy based on the O_2 content and the solution annealing temperature. With this knowledge the alloy can be utilized for high-temperature use with more confidence. Alloys based upon the Nb–V system are also under study

for high-temperature applications. They possess superior yield and tensile strength over the Nb–1% Zr alloy up to 1090°C and in addition offer a more favorable density. A hot-hardness test was developed as a means of rapidly evaluating binary alloys in this system. This test proved to correlate very well with conventional tensile tests. The maximum tensile strength was found to occur between 30 and 50% V. Data from slow-bend tests, which were used as a substitute for creep tests, indicated the creep strength of the Nb–V system to be inferior to that of the Nb–1% Zr alloy at 1200°C. It became desirable to determine more exactly the melting range of commercially produced INOR-8 as part of the study of factors leading to fissuring of weldments. The solidus temperatures were established as being between 2435 and 2480°F, and the liquidus temperatures between 2552 and 2559°F. Since the solidus temperatures range from 80 to 180°F above the corresponding nil-ductility temperatures, it is doubtful that a liquid phase is responsible for the fissuring. The creep resistance and thermal stability of U–Mo alloys containing 10 to 15 wt % Mo increased with the Mo content, but at the expense of increased notch sensitivity at low temperatures. A H_2 absorption technique was developed which permits the transformation kinetics of the reaction $\gamma \rightarrow \gamma' (U_2Mo) + \alpha$ (uranium) to be quantitatively determined. The surface reactions of metals with their service environment are an important area of study. The behavior of structural alloys in high vacuum and with inert gases containing partial pressures of active gases is under investigation. The evaporation characteristics of types 316, 304, and 446 stainless steels, INOR-8, Inconel, and Haynes alloy No. 25 were determined at 871 and 982°C at pressures of 5×10^{-7} torr. The alloying elements selectively evaporate in proportions that appear to be dependent upon the vapor pressure and the concentration of the elements. For example, it was determined that the evaporation rates increased with increasing chromium content of the alloy. Studies of the reactions between type 304 stainless steel with CO and CO_2 were continued as part of the fuel element development program of the EGCR. From a study of numerous variables it was established that undesirable oxidation reactions could be avoided by atmospheres high in carbon monoxide content. These atmospheres promoted the formation of spinels and Cr_2O_3 at rates dependent upon the P_{CO_2}/P_{CO} ratio and the temperature. Although increases in the proportion of CO increased the extent of carburization up to a $(P_{CO})^2/P_{CO_2}$ value of 0.227, further increases in this ratio thereafter resulted in less carburization. This effect was attributed to the presence of Cr_2O_3 at the metal surface, which served as a barrier for carbon diffusion. The oxidation resistance of types 316, 446, and 310 stainless steels, Haynes alloy No. 25, Inconel, and INOR-8 was determined at 927, 982, and 1038°C. The oxidation rates were lower for the Ni-base metals even though they contained less Cr than the other alloys did. Attempts to clad Nb tubing with type 304 stainless steel to prevent contamination were partially successful when Ag was used as an intermediate layer. Bond separation occurred at the Ag–type 304 stainless steel interface when the tubing was mechanically deformed subsequent to thermal cycling. Nickel coatings on a U–10 wt % Mo alloy for oxidation resistance were judged to be unreliable because the coated alloy exhibited an inconsistent and unpredictable oxidation behavior. Gaseous contamination of Nb and its alloys between 850 and 1200°C was observed at pressures as low as 3×10^{-6} torr. With air as the impurity gas, Nb is contaminated with both O_2 and N_2 in the proportions 100 : 1 even though the impurity gases are in the ratio 1 : 4. Since the permissible gas impurity levels in contact with the heated metal for extended exposure times were estimated to be in the range 1×10^{-7} torr, it was concluded that high-temperature tests should be conducted in vacua rather than in purified inert gases. Preliminary results indicated that the oxidation characteristics of a Be–0.5 wt % Ba alloy in CO_2 depend upon the CO_2 pressure. This behavior is unlike that of unalloyed Be. However, the oxidation resistance was inferior to that of the unalloyed metal. Additional preliminary data showed that thin-walled Mo tubing can be made and that this metal is tolerant of high proportions of water vapor. (auth)

30168 (ORNL-3313(p.65-132)) PART III. METAL AND CERAMIC FABRICATION. G. M. Adamson, Jr. (Oak Ridge National Lab., Tenn.).

Ceramics Laboratory. Experimental studies were performed in the general areas concerned with BeO and fueled BeO, graphite and fueled graphite, bulk UO_2 and ThO_2, thermal conductivity studies, and Eu_2O_3 and Sc_2O_3. Techniques were developed for preparing approximately 900 cold-pressed and sintered BeO specimens for use in irradiation tests designed to systematically study the effects of grain size (approximately 20 to 70 μ), density (90 to 97% of theoretical), pore structure, thermal stress, and temperature (approximately 100 to 1000°C) on the behavior of this material at high fast-neutron doses. The techniques were so designed that sintering to final dimensions was carried out at 1750°C in H_2 for all types of specimens. Techniques also were developed for preparing fueled BeO specimens of controlled density and microstructure; spheroidal UO_2 particles were prepared by a method which promotes uniform densification during sintering. Phase studies using the porous collector technique showed that in the BeO–MgO–ZrO_2 system the eutectic temperature is 1720 ± 10°C and extensive solid solubility exists in the ZrO_2-rich region of this system and that a eutectic reactions occurs at 2080 ± 10°C in the MgO–ZrO_2 system at a composition of 35 ± 2 mole % ZrO_2. Studies in the O–U system showed that the weight loss of UO_{2+x} at temperatures greater than 1200 to 1300°C is quantitatively consistent with the loss either of O_2 and UO_3 or of UO_4 as volatile species; pressure-temperature relationships for equilibrium between U_3O_{8-y} and UO_{2+x} were determined. Fueled graphite work was concerned primarily with the systems and configurations of interest to the Pebble-Bed Reactor Experiment. A variety of techniques were investigated for fabricating graphite spheres containing pyrolytic-carbon-coated fuel-carbide particles; a method involving pseudohydrostatic loading at room temperature was shown to hold major promise for this application. Evaluation of coated particle materials was continued on an expanded basis with emphasis on the correlation of measurable properties with performance during irradiation. Approximately 1300 UO_2 specimens of various sizes, shapes, and grain sizes were prepared by cold pressing and sintering for use in irradiation tests, and methods were developed for activating nonsinterable, highly enriched UO_2 powders so as to increase the sintered bulk density from 66 to 95% of theoretical. Methods for optimizing particle properties, particle-size distributions, and fabrication variables were investigated for vibratorily compacted rods containing oxide fuels prepared both by arc fusing and by the sol-gel process. Uniform bulk densities of 89 to 91% of theoretical were achieved. The effect of measurable physical properties of pressed and sintered ThO_2 pellets on attrition resistance was investigated; it was shown that variations of bulk density per se in the range 92 to 97% of theoretical were not so significant as sintering time and therefore grain size. The thermal conductivity of sintered UO_2 specimens was

determined to a precision of ±1% at 27 to 875°C by the radial heat flow technique. A significant increase in the conductivity was observed at temperatures below 600°C after the material was heated to 875°C; this effect was attributed to a slight loss of O_2 during exposure of the specimens to the higher temperatures. The swelling of certain Eu_2O_3 compacts at 1350°C was eliminated by vacuum heat treatment of the Eu_2O_3 powders at this temperature prior to compacting. The effect appears to be associated with the presence of a hydroxycarbonate phase in those compacts which exhibit swelling. The sintering characteristics of Sc_2O_3 and the compatibility of this oxide with 13 other oxides were determined. The results were similar to those previously reported for Y_2O_3. Metal Forming and Casting. The development of materials for potential application to low-temperature reactors (60 to 180°F), medium-temperature reactors (400 to 1100°F), and high-temperature systems (>1100°F) continued. In the low-temperature reactor field, postirradiation examinations of high-investment Al-base fuels were completed. The excellent radiation performance of U_3O_8 dispersions was revealed by the absence of swelling in miniature samples irradiated at 200°F to U^{235} fission burnups of 77 at.%. The examination of a 19-plate prototype element containing 63 wt % U_3O_8-Al dispersions, which was irradiated in the lattice of the ORR to an average U^{235} fission burnup of 41 at.%, further substantiated the excellent radiation stability of this system. Fuel plates from this element resisted swelling and blistering in postirradiation heat-treatment tests extended over the range 400 to 1000°F. X-ray diffraction studies on the dispersion fuels indicated that the U_3O_8 particles had become amorphous under irradiation. A disordered form of UAl_3 was identified as one of the reaction products in the irradiated U_3O_8-bearing dispersion fuels. Similar studies on the 48 wt % U–3 wt % Si–Al alloy fuels showed a conversion of the ordered Si-modified UAl_3 structure to a disordered UAl_3 formation in these samples as a result of irradiation. The development of high-strength corrosion-resistant Al-base fuel plates for application in high-neutron flux reactors, such as the High-Flux Isotope Reactor (HFIR) and the Advanced Test Reactor (ATR), continued. The blistering initially associated with fabrication of the type 6061 Al-clad fuel plates for the HFIR was drastically reduced by plate processing modifications. The feasibility of manufacturing the complex HFIR fuel units to close dimensional tolerances was further demonstrated by assembling both inner and outer annulus units. The close dimensional tolerances required in these assemblies dictate rigid control of the reproducibility of the involute curvatures in the formed plates. Although considerable progress was made in forming, the yield of reproducibly formed fuel plates is presently unsatisfactory. The development of the more corrosion-resistant type X8001 Al-clad fuel plates for the ATR has provided a unique opportunity for investigating fabrication variables due to the long length and width range required in the fuel plates. Cross rolling and tandem core billet designs were used to develop procedures for fabricating to the required dimensional tolerances 19 fuel plates consisting of type X8001 Al cladding on a U_3O_8 dispersion core. The technical feasibility of mechanically joining the fuel plates into the required fuel element design was demonstrated. Difficulty was encountered, however, in forming the fuel plates to meet the dimensional specifications of the water channel spacings in the assembled element. Fabrication studies were continued on swaged UO_2-stainless steel fuel rods. To demonstrate the irradiation stability of such rods, 18 rods containing fused and ground UO_2 were satisfactorily fabricated to manufacture an element for irradiation testing. The feasibility of fabricating Enrico Fermi type III spherical UO_2-stainless steel fuel plates with integral spacers was demonstrated. Fuel plates were fabricated with sufficient cladding thickness on one side to permit machining of the integral spacers. Difficulties encountered in maintaining plate flatness during fabrication were overcome by machining the spacers and subsequently annealing. In the development of stainless steel-clad plate-type neutron absorbers, the postirradiation examination of 20, 30, and 40 wt % Eu_2O_3 dispersions in elemental stainless steel continued to show good irradiation stability at neutron exposures up to 2.9×10^{21} nvt. Studies were continued on the boron-gradient concept and on advancing the fabrication technology. The feasibility of manufacturing an absorber which utilizes both the good irradiation behavior of Eu_2O_3 and the economical advantages of B was demonstrated by fabricating plates with 37 wt % Eu_2O_3-elemental stainless steel tips and boron-gradient follower sections. In the high-temperature materials field, Nb–V-base alloys with closely controlled compositions were satisfactorily melted by an Ar atmosphere, W-electrode, arc-melting process. Fabrication studies showed that the Nb–V alloys in the cast condition can be heavily cold-rolled without fracture. Investigations of zone melting in an electron-beam furnace demonstrated the feasibility of producing large, single crystals of Nb and possibly other refractory metals. Powder Metallurgy. A volatile (removable) sintering-temperature depressant was used to fabricate an essentially all-uranium carbide fuel at temperatures as low as 1300°C, which is 600 degrees lower than the temperature required for sintering straight UC. With stoichiometric or slightly hyperstoichiometric UC and UAl_2 in amounts of 5 to 10 wt % used as the sintering aid, monocarbide bodies of around 93% of theoretical density were achieved. Preliminary results of hot-hardness tests indicated substantial dispersion hardening in hot-pressed and extruded compacts of Th–10 vol % AlO(OH), Th–10 vol % ZrO_2, and Th with ThO_2 introduced by milling. Compatibility studies between Th and fissile particles of UO_2, UC, and UC_2 indicated the need for reaction barriers. Pyrolytic-carbon-coated UC and UC_2 were the most resistant of the coated particles examined, giving protection to 1100°C. Dense high-quality beryllide fuels having potential for breeder reactors were fabricated by both the hot-pressing method and the cold-pressing and sintering method. Preliminary dissolution tests in standard 4 M HNO_3 showed that $ThBe_{13}$, UBe_{13}, and $(Th_9U_1)Be_{13}$ dissolve readily. Oxidation tests showed $ThBe_{13}$ to have good oxidation resistance at 700°C. Experimental studies showed that the duplex core required for the HFIR inner-annulus fuel plate can be produced in a single cold-pressing operation, greatly simplifying and reducing costs of fabrication. With this innovation, the serious blistering problem associated with the former hot-forging steps is eliminated. Special procedures were evolved for cold pressing ATR fuel cores to extremely close thickness tolerances (±0.0015 in.), thereby mollifying the task of rolling plates to rigid straightness requirements. In developing the target component of the HFIR, a blending procedure involving a rod-milling action was shown to be effective in mixing 10 to 25 vol % actinide oxide in Al. A technique was developed for pressing target pellets without spreading contamination. The actinide oxide-Al mix was completely enclosed in a primary Al containment, and the pellets then clad in a finned tube. Studies of the physical and mechanical properties of the target pellet and an evaluation of the adaptability of the fabrication sequence to remote operation are in progress. Remote Fabrication Development. The efforts of the Remote Fabri-

cation Group were directed toward designing and developing equipment and facilities for remotely fabricating reactor core components containing Th, U^{233}, Pu^{242}, or the transuranic elements. Criteria were established for the proposed Th Fuel Cycle Development Facility (TFCDF), which will be used for investigating the complete Th-U^{233} fuel cycle. Fuel elements up to 12 ft in length can be disassembled, chemically processed, reconstituted, refabricated, and inspected in the proposed facility. A Th-U^{233} fuel rod facility is being built for use in extending fuel cycle technology through the development of techniques and equipment for the remote fabrication of Zircaloy-2-clad fuel rods containing Th-3 wt % U^{233} oxide. These elements will be used for critical experiments at the Brookhaven National Laboratory. Equipment is being provided for the following remote operations: comminution, screening, weighing, blending, and vibratory compaction of oxide powder and end capping, cleaning, and inspection of fuel rods. Construction of the facility structure is 20% complete, design of process equipment is 80% complete, and equipment fabrication and procurement are 30% complete. Two lines of equipment for fabrication and inspection of target elements for the High-Flux Isotope Reactor (HFIR) are being designed and developed. One is for the production of target elements containing Pu^{242}, which will be used for the first loadings of the HFIR target; the other is for manufacture of elements in the Transuranium Processing Plant (TRU). The Al-clad elements will be processed in TRU both to remove the desired isotopes and to permit recycling of certain isotopes to the reactor. The fabrication and inspection procedures, which are essentially the same for both the Pu-bearing element and the actinide-bearing element, involve calcination to form an oxide; powder-metallurgical steps to form an Al-clad pellet containing a pressed mixture of oxide and Al powder; pellet decontamination and mensuration; tube loading, end capping, and collapse steps to make a hermetically sealed element for containing pellets in intimate contact with the inside wall of the tube; and decontamination and inspection operations to ensure that the target element is radiologically safe and that it meets all specifications for weld integrity, dimensions, and distribution of target material. The equipment being developed for TRU will be semi-automatic in operation to allow completely remote handling of the process. The equipment for handling Pu^{242} will be installed in unshielded glove boxes and accordingly will be of simpler design than that for TRU. The design of the TRU equipment is approximately 20% complete. Procurement of equipment for the Pu^{242} work has commenced. Welding and Brazing. The development of suitable procedures for fabricating various reactor components composed of materials ranging from Al and stainless steels to Be and Nb constituted a major portion of the work of the Welding and Brazing Laboratory. Improved procedures for reducing shrinkage during welding were developed for fabricating prototype fuel elements for the HFIR program. Manual procedures were used successfully for welding the fuel plates on the inside and outside of the two annuli but in order to satisfy future production requirements, considerable emphasis is being placed on the development of automatic procedures. Procedures for fabricating the stainless steel-clad UO_2 fuel element for core B of the Enrico Fermi Reactor to the tight dimensional tolerances required were completed. A highly complex boiler assembly for a liquid-metal loop experiment was satisfactorily fabricated, as were several complex, instrumented, stainless steel, irradiation capsules with internal thermocouples. Methods for remotely brazing pipe joints for molten-salt service were devised, as were techniques for making the various thermocouple and burst-slug-detection tube penetrations through the pressure vessel of the EGCR. Several very promising alloy compositions were formulated for brazing Nb, and the joints had excellent room- and elevated-temperature strengths. Procedures were developed for making end-closure welds in Be tubes with a strength of about 10,000 psi at 600°C. Experimental brazing alloy compositions were designed which readily flow on the oxide ceramics, and a demonstration compartmented fuel element of Al_2O_3 was fabricated. Successful procedures were developed for joining ferritic steels to austenitic steels for high-temperature cyclic service. Postirradiation Examination. Remote-replication techniques for macroscopic surface examinations were expanded to obtain replicas of sufficient quality for electron-microscope examinations. A total-body replication technique was developed for preparing nonradioactive duplicates of small objects such as 0.220-in.-diam irradiated ThO_2 spheres and $2\frac{1}{2} \times 8 \times \frac{3}{8}$ in. sections of the HRE-2 core wall for detailed examination outside the hot cell. The surface topography produced had suitable detail for examination at up to 1000X. Essentially all the metallographic equipment for use in the new PIE laboratory has been fabricated and tested. Supporting equipment such as manipulators, waste disposal canning and cleaning devices, optical equipment, and service plugs are in various stages of construction and testing. The remote scanning tank for use with ultrasonic inspection equipment is being slightly modified after an exhaustive mockup testing period. The shielded x-ray diffraction goniometer was completely assembled in a temporary location and on the basis of preliminary tests will provide satisfactory diffraction patterns. (auth)

30169 (ORNL-3313(p.133-78)) PART IV. APPLIED RESEARCH. C. J. McHargue (Oak Ridge National Lab., Tenn.).

Physical Properties of Ceramics Studies. The Physical Properties of Ceramics Group continued studies of methods of determining thermal conductivity at 20 to 1000°C. The effects of the chemical and physical state of UO_2 on thermal conductivity is being studied in a thermal comparator apparatus that is operable to 400°C with a precision of ±3%. Measurements that were precise to ±1% and accurate to ±3% were made on UO_2 to 875°C in a radial heat flow apparatus. Equipment was constructed for measuring the thermal diffusivity to 1700°C by a quenching method. The total hemispherical emittance of INOR-8, Nb-1% Zr, and Pt was measured to 1000°C by electrically heating a strip specimen in a constant-temperature blackbody vacuum chamber. Sintering Studies. Heating thoria powder compacts to any given temperature gave a temperature-dependent densification end point free from the effects of the heat-up cycle. An increase in densification rate of ThO_2 compacts at 1450 to 1600°C was observed which far exceeded the increase in rate of self-diffusion, suggesting that volume diffusion is not the dominant material transport mechanism. Several experiments gave densification characteristics that are compatible with a dislocation-movement transport mechanism. Weld necks formed between small crystals and the cleaved face of large CaF_2 crystals were surrounded by a high concentration of dislocations. Sintering of a CaF_2 pellet containing a small hole resulted in smaller grains around the hole. Preliminary data on self-diffusion of Th and O_2 in ThO_2 were obtained. Solid Reaction Studies. Diffusion coefficients of Al^{26} and Mn^{54} in Al were determined at 450 to 650°C. Reaction between hot-pressed Be and UC was found to occur throughout the range 700 to 1000°C, to result in a layer of UBe_{13} with uniformly dispersed free C, and to be controlled by the diffusion of Be in UBe_{13}. Diffusion coefficients of Zr^{95} and Nb^{95} in beta-Zr were deter-

mined over the range 900 to 1750°C. Preliminary experiments were performed in a study of the diffusion of Ti^{44} in Ti. Preliminary data on the diffusion of Nb in both pressed and sintered UO_2 pellets and fused UO_2 indicated a diffusion coefficient of 1.46×10^{-10} cm^2/sec at 1505°C. A method for separating grain-boundary effects involving penetration plots obtained for polycrystalline materials was developed. Metallurgy of Superconducting Materials. Microstructural examination of diffusion couples and as-cast ingots of the Nb-Sn system showed that there are at least three and probably five intermediate phases. Approximate melting points of some of the phases are, from the most Nb-rich side to the least-rich side, greater than 1000, 940, and 850°C for the first three phases. Transformation kinetic studies of Zr-Nb alloys containing from 25 to 40 at.% Zr at temperatures from 500 to 950°C showed that a lamellar structure is produced sluggishly at 800 and 900°C, more rapidly at 600 and 700°C but too fine to be resolved optically, and not at all at 500°C in 24 hr; increasing the Zr content increases the rate of reaction at all temperatures; the reactions at 500 and 600°C do not seem to produce α-Zr in the initial reaction; and the segregation during freezing is quite severe and an important problem. In tensile tests of as-fabricated Nb–25% Zr 0.010-in. dia wire the ultimate tensile strength at 4.2°K was about 330,000 psi. Purified Tc, Tc-Zr, and Tc-Mo ingots were arc-cast and hot-press-forged. The as-cast Tc–10 wt % Zr alloy consists of a primary body-centered cubic phase and a very small amount of divorced eutectic with a second cubic phase. A 50% Tc–50% Zr alloy is almost single-phase close-packed hexagonal. From resistance measurements, the critical temperature (in zero field) of purified Tc was found to be 8.26°K. Zirconium Alloy Research. Studies of the formation of an ω phase during aging of Zr–15% Nb–X alloys showed that decreasing the "betatizing" temperature and time, increasing the aging time at room temperature between beta quenching and elevated-temperature aging, and using slower quenching rates increase the incubation time and decrease the rate of formation of the ω phase. The evidence indicated that the formation of ω phase is affected by the vacancy concentration of the alloy at the time of aging at elevated temperature. The validity of using aging curves determined by hardness measurements at room temperature after quenching from the aging temperature to show the correct transformation kinetics was confirmed by hot-hardness measurements during aging at 400°C. The solubility of Nb in alpha-Zr as determined by metallographic examination disagrees considerably with that determined from resistivity measurements during heating and cooling. The redetermination of the solubility curve is continuing. Continued study of the strain anisotropy in Zircaloy-2 disclosed that although the strain-strain equations derived from Hill's theory of anisotropy are experimentally verified, the theory, as developed, should not be applied to Zircaloy-2 since several of the essential assumptions are violated. It may be that the restrictive assumptions are not necessary. The room-temperature yield strength in compression was indicated to be as high, for certain textures, as 122,000 psi, while the yield strength in tension will be only 70,000 psi. Oxidation-rate data for Zircaloy-2 obtained with a technique that permits determination of the time required to form a 20-A-thick layer of oxide to an accuracy of 5% or better showed that the oxidation rate is not smooth on a fine scale but has a cyclic variation in the rate. The oxidation process seems to be smoother at 600 than at 450 or 500°C. Thin-film oxides in situ (produced by anodizing Zr) examined in a polarizing spectrometer appeared to absorb strongly at light wavelengths less than 2500 A. X-ray diffraction measurements showed that the anodized film is essentially amorphous (give no x-ray diffraction maxima). No difference was observed in the optical properties of anodized films and those produced by water corrosion at 300°C. Metallography. Transmission electron-microscope studies of Nb were used, with considerable promise, in helping to associate deformation bands, textures, and dislocation networks and to detect subgrains after low-temperature annealing. Preliminary studies were made on the interaction of impurities with dislocations during aging and recrystallization. Hot-hardness testing was used as a quick survey method for preliminary evaluation of the strength of metals and alloys and for evaluating high-temperature deformation characteristics. In support of the reactor projects both in general and radiation metallography, pyrolytic-carbon-coated uranium carbide fuels were examined in detail to appraise uniformity and homogeneity in both the coatings and the fuel. Various types of fuel elements were examined in the hot cells after extended fuel burnup to evaluate the integrity of the element and the condition of the fuel and contiguous matrix. In the SM-1 fuel element the maximum life seemed to be limited more by corrosion rates than by dimensional instability of the fuel. Uranium carbide particles compacted in graphite and irradiated in the MTR increased in volume in relation to void formation; however, no grain structure could be resolved by known techniques. (auth)

30170 (ORNL-3313(p.179-208)) PART V. FUNDAMENTAL RESEARCH. B. S. Borie (Oak Ridge National Lab., Tenn.).

Crystal Physics. The program for developing methods for growing quality crystals of controlled purity was continued. A variety of crystal growth systems are being used in the attempt to synthesize large crystals of a large number of oxides, certain alkali metal halides, and some metals and intermetallic compounds. Deformation of Crystalline Solids. The stored energy resulting from deformation of crystalline solids was measured for a series of Cu-Zr and Ni-Al alloys at 77 and 243°K. It was found that the rate of energy storage increases with strain for the first 20% elongation. Alloying increases the energy storage greatly while increasing the strength relatively less. A reduction in temperature increases the energy stored in pure metals significantly but has only a minor effect on the more concentrated alloys. Work was started on interpreting these results in terms of the changes produced inside the metal during deformation. Reactions at Metal Surfaces. Studies of the fundamental mechanisms of oxidation of metals were continued, with particular emphasis placed on the role of mechanical stresses in controlling the degree of protectiveness in oxide films. Evidence of large stresses in Ta specimens resulting from the solution of O_2 in the Ta lattice was provided by hot-stage microscopy techniques and by direct measurements of the flexure of Ta specimens exposed to O_2 on one side only. Investigations of the nitridation and low-pressure oxidation of Ta were initiated, and sulfidation studies revealed the occurrence of a maximum in the rate of sulfidation of Ta at 700 to 800°C. Additional x-ray and optical studies of epitaxially induced strains in Cu_2O films were also undertaken. Spectroscopy of Ionic Media. A high-temperature spectrophotometer of improved design was procured for the study of absorption spectra at 1000°C over the wavelength range 186 to 2600 mμ. A multispecies model was developed for the phenomenological light-absorbing behavior of solutions of Bi metal in molten $BiCl_3$. Progress was made toward developing a code for calculating multicenter wave functions for molecules and molecule ions. Structure of Metals. Mechanical twins

were found in electron-beam-melted Nb deformed by high-speed impact at room temperature and by slow or fast compression at −196°C, and their crystallographic characteristics were determined. The addition of interstitial elements inhibited twinning and gave increased amounts of cleavage cracking on {100} planes. Theoretical expressions were developed for impurity-controlled and impurity-independent grain-boundary migration during recrystallization. These expressions were confirmed by data from alloys of 0.00021 to 0.0256 at.% Cu in zone-refined Al. A new treatment was developed for obtaining axis distributions from pole distributions. Deformation studies were initiated on the difference in behavior of grains in aggregates and single crystals and on the effect of reactor irradiation on subsequent preferred orientation in Cu. Theory of Alloying. The early transition metals Ti, Zr, Hf, V, Nb, Ta, Mo, and W and their alloys were considered in terms of electronic structure, alloy models, and crystalline defects. These metals and their alloys include high-field superconductors such as Nb_3Zr, which is under development in order to provide high fields for Fermi surface studies. Heat treatment of this superconductor at 800°C was found to give a tenfold increase in critical currents, apparently as a result of strains arising during the early stages of precipitation. The mechanism of the heat treatment was more closely understood when it was shown to be greatly enhanced by additions of O_2 and C. The precipitating phase is apparently a compound such as ZrO or ZrC. Size-effect studies of Nb-Zr superconductors showed that the main superconducting currents in small wires flow in a 10^{-4}- to 10^{-3}-cm depth on the surface. Critical current density was found to be greatly increased in small-diameter wires and to be inversely proportional to the diameter in wires with etched surfaces. The conventional insulation of superconducting magnets had shortened their lifetime because of a rapid transition time from the superconducting state to a normal state. The use of pure metal foils between layers of the magnet coils greatly extended the magnet lifetime. A study was made of transverse magnetoresistance in pure W. With current flow in ⟨100⟩ and ⟨110⟩ directions, the magnetoresistance was anisotropic upon rotation of the magnetic field direction, while maintaining the field perpendicular to the current. Magnetoresistance increased in all directions quadratically with field strength, suggesting closed Fermi surfaces in W with equal numbers of holes and electrons. The low-temperature specific heats of α-Zr were completed for dilute additions of Ag, Cd, In, Sn, and Sb. The density of states increases linearly with these solutes in direct proportion to the solute valency. The Debye temperatures decrease linearly with each solute but the rates of change with valency are more complicated. New information was determined on the phase diagrams Zr-Ga and Zr-Pb. X-Ray Studies of Crystalline Defects. Diffuse intensity measurements on the alloy Cu−16 at.% Al and their interpretation were completed. A model was found which convincingly reproduces the experimentally determined short-range-order parameters for this alloy. A study of monochromators and their design and construction led to an improvement by more than a factor of 2 in the monochromatic x-ray intensity available for diffuse scattering studies. X-Ray Diffraction. Service functions of the X-Ray Diffraction Group are summarized. Research programs were continued in the fields of radiation damage in beryllia, order-disorder phenomena in nonstoichiometric Cu-Au, and determinations of the crystal structure of several mixed oxides of fundamental and practical interest. Abstracts of publications on these subjects are given. (auth)

30171 (TID-5001(4th Rev.)) SUBJECT HEADINGS USED BY THE U.S.A.E.C. DIVISION OF TECHNICAL INFORMATION. Charles W. Hargrave (Division of Technical Information Extension, AEC). Aug. 1962. 375p.

A list is presented of subject headings used by the U.S.A.E.C. Division of Technical Information for indexing literature in the field of nuclear science and technology. (C.H.)

30172 (TID-16489) QUARTERLY PROGRESS REPORT NO. 66 [ON ELECTRONICS]. H. J. Zimmermann, G. G. Harvey, and W. B. Davenport, Jr. (Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics). July 15, 1962. Contract AT(30-1)-1842. 456p.

Research activities are reported in the areas of physical electronics, microwave spectroscopy, optical and infrared masers, nuclear magnetic resonance and hyperfine structure, microwave electronics, molecular beams, radio astronomy, physical acoustics, noise in electron devices, plasma physics, plasma electronics, plasma magnetohydrodynamics and energy conversion, statistical communication theory, processing and transmission of information, speech communication, signal detection by human observers, mechanical translation, linguistics, communications biophysics, neurophysiology, neurology, and sensory aids research. (J.R.D.)

30173 (JPRS-15086) SCIENCE HAS DEMONSTRATED: NUCLEAR EXPLOSIONS CAN BE DETECTED WHEREVER THEY OCCUR. I. P. Pasechnik. Translated from Priroda, No. 7, 3-12(1962). 18p.

Brief descriptions are given of the most widely used methods for the detection of nuclear explosions set off underground, under water, in the atmosphere, or in space. The production of aerial subsonic waves, hydroacoustic waves, and seismic oscillations by nuclear explosions is discussed. Procedures for the detection and identification of these waves are discussed. It is pointed out that, while these waves can be detected at great distances, it may not be easy to accurately determine their source. However, there are certain phenomena that are characteristic only of a nuclear burst. Carbon^{14} formed at the time of any thermonuclear explosion enters the atmosphere, and γ radiation occurring at the time of a surface or aerial nuclear burst gives rise to a radio signal that is propagated through the waveguide of the earth and ionosphere. Due to the fact that this signal is repeatedly reflected, first from the earth and then from the ionosphere, it can be detected by receivers at very great distances. The radio signals from lightning are similar in form and frequency range to those from nuclear explosions and make it difficult to detect nuclear explosions from a study of these waves. Aerial bursts can be detected by recording the electromagnetic radiation, earth currents, ionospheric and magnetic disturbances, the light flash, and the glow in the sky that is similar to that observed at the time of auroras. At the time of explosions set off at very great heights there are significant changes in the earth's magnetic field, the structure of the ionospheric layers, and the earth's radiation belts. These explosions can be detected by ground observation. (C.H.)

30174 THE NUCLEAR STUDY CENTERS OF THE NATIONAL COMMITTEE FOR NUCLEAR ENERGY. Umberto Belliazzi and Nicola Greco. Ing. Nucleare, 4: 119-30(July-Aug. 1962). (In Italian)

Experiments arising out of the construction of nuclear research centers belonging to the CNEN, viz. the National Laboratories at Frascati, the Ispra Nuclear Study Centre, and the Casaccia Nuclear Study Centre are reported. Par-

ticular study conditions caused by the unforeseeable development of the Center's requirements are referred to. It is indispensable to aim at elasticity in every undertaking planned so as to ensure maximum utility in the present and the possibility of meeting further needs in the future. An account is given of events leading up to the creation of the three centers, the criteria followed, and the preliminary studies carried out, as well as the main problems that solved. Special attention is paid to the loading trials carried out on the model of the large topmost floor of the reactor building at the Ispra Centre, to the same Centre's problems of water supply, and to the construction of the Gamma Field at the Casaccia Centre. (auth)

30175 NUCLEAR SCIENCE ABSTRACTS OF JAPAN. MARCH 1962. VOLUME 1, Number 3, 4. Nuclear Sci. Abstr. Japan, 1: Nos. 3-4, 1-174(Mar. 1962). (In English)

A total of 221 abstracts are presented on government-sponsored research in the field of atomic energy carried out from April 1959 to March 1961. The abstracts are arranged into categories dealing with fuel elements, moderator and reflector materials, reactor materials, radiation shielding, radiation measurement, nuclear-powered ships, fusion, radiological protection, and use of radioisotopes. (D.L.C.)

30176 LIKELY EFFECTS OF PRIVATE OWNERSHIP OF SPECIAL NUCLEAR MATERIALS. K. D. Nichols. Preprint Paper No. 43. New York, Engineers Joint Council, 1962. 16p.

The Atomic Energy Commission's reasons for considering private ownership of nuclear materials and the views of the Atomic Industrial Forum, the Edison Electric Institute, the U. S. Chamber of Commerce, and the American Public Power Association on the subject are presented. Six proposals of the Atomic Energy Commission leading toward private ownership are listed and their probable effects are discussed. It is concluded that a transition period will be necessary, and that the ground rules for the transition should be established as soon as possible. (A.G.W.)

30177 METHOD OF CARRYING OUT THE THERMAL TREATMENT OF MATERIALS IN PHYSICAL OR CHEMICAL REACTIONS BY NUCLEAR ENERGY. (to Brown, Boveri and Cie Aktiengesellschaft). British Patent 905,559. Sept. 12, 1962.

A method is given for carrying out physicochemical reactions in a reactor as a furnace. Both continuous and interrupted operation of the reactor are considered. The production of CaC_2 from CaO and C is discussed as an example. (D.L.C.)

BIOLOGY AND MEDICINE

General and Miscellaneous

30178 (ANL-6474) RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT, JULY–DECEMBER 1961. (Argonne National Lab., Ill.). Apr. 1962. Contract W-31-109-Eng-38. 98p.

Research and development progress on radiological physics is reported. Ten papers and four abstracts of papers are given. Separate abstracts were prepared for 9 papers. One was previously abstracted for NSA. (M.C.G.)

30179 (ANL-6474(p.4-6)) FLUORESCENCE QUENCHING OF A SCINTILLATING SOLUTION BY OXYGEN. T. Walter and I. B. Berlman (Argonne National Lab., Ill.).

A method is presented for determining the rate constant for oxygen quenching of a solute in a cyclohexane solution. The results reaffirmed that solute quenching by oxygen is a diffusion controlled process. (M.C.G.)

30180 (ANL-6474(p.11-13)) LIQUID SCINTILLATOR SOLVENT STUDY FOR THE PURPOSE OF IMPROVING THE "TWIN" SCINTILLATION FAST NEUTRON DETECTOR. PART III. Roger Grismore and B. G. Oltman (Argonne National Lab., Ill.).

The relative light yields of several liquid scintillator solutions were determined as a continuation of the program for improving the "twin" scintillation fast neutron detector. Each solution consisted of 4 g/l diphenyloxazole in the organic solvent under study. Results are presented in tables. (M.C.G.)

30181 (ANL-6474(p.14-21)) SYSTEM FOR RECORDING PULSE SHAPES. PRELIMINARY REPORT. Orville J. Steingraber (Argonne National Lab., Ill.).

A method of accurately recording scintillation pulse contours in the range of 10^{-9} sec is described. The excitation may be by pulsed uv, beta, or alpha sources. Random pulses are sampled as to height by a standard pulse sampler. Each pulse height sample is then converted to digital information and stored in the memory of a multichannel pulse-height analyzer. After a sufficient number of samples are taken to give a smooth curve, the information is plotted on an x-y recorder. The analyzer requires some modification as it is not used in the conventional manner. (auth)

30182 (ANL-6474(p.25-41)) OPTIMUM CHOICE OF PARAMETERS IN ORDER TO DISTINGUISH BETWEEN LINEAR AND SQUARE DOSE-RESPONSE CURVES. John H. Marshall (Argonne National Lab., Ill.).

A method to calculate the number of animals required to distinguish between a square and a linear dependence of the incidence of cancer in mice on absorbed radiation dose is described. Expressions were developed and graphs are presented. (M.C.G.)

30183 (ANL-6474(p.42-50)) ACTIVATION ANALYSIS OF SOME HEAVY NUCLIDES. Richard B. Holtzman (Argonne National Lab., Ill.).

Calculations were made to compare the sensitivities of neutron activation analysis with radiochemical and chemical techniques used for the determination of U, U^{235}, Th^{232}, Th^{230}, Th^{228}, Pa^{231}, Ac^{227}, Ra^{228}, and Ra^{226}. Methods of neutron activation analysis and analysis by charged particle reactions are described. Results indicated that neutron activation is useful for analysis of U, U^{235}, Th^{230}, Th^{232}, and Pa^{231}. Radiochemical techniques appeared more suitable for Th^{228}, Ac^{227}, Ra^{226}, and Ra^{228}. (M.C.G.)

30184 (ANL-6474(p.52-7)) EFFECTS OF RADIATION ON ROTIFERS IRRADIATED AT DIFFERENT AGES. Patricia McClement Failla (Argonne National Lab., Ill.).

Dose-effect curves are given for the number and hatchability of eggs laid on the 7th day by rotifers irradiated at one day of age. These are very radio-resistant parameters, yet they were previously found to be more sensitive indicators of radiation damage than survival time. In an effort to determine the reasons for the radioresistance of rotifers, they were exposed to 50,000 r at different ages. The number of eggs laid on the 7th day by the exposed generation and by members of the next (unirradiated) generation was determined as was the hatchability of these eggs. The variation of these parameters with the age of the rotifer at the time of irradiation indicated that the most immature egg cells are the most radiosensitive. Nevertheless, 50,000 r delivered at the most sensitive stage only reduced subsequent egg production to about 50% and hatchability to 20%. (auth)

30185 (ANL-6474(p.58-72)) THE EFFECT OF METEOROLOGICAL VARIABLES UPON RADON CONCENTRATION THREE FEET ABOVE THE GROUND. Harry Moses, Henry F. Lucas, Jr., and Gunther A. Zerbe (Argonne National Lab., Ill.).

Case studies based on a time-series comparison of radon and pertinent meteorological variables for periods of clear weather, extremely windy weather, unusually moist ground, and snow cover are presented. A climatological summary is given of the radon measurements as shown by relative frequency diagrams for the four seasons, time of day, and various ground conditions. (M.C.G.)

30186 (ANL-6474(p.73-81)) CONVECTIVE TURBULENCE WIND TUNNEL PROJECT CALIBRATION TOWING CHAMBER. Edward J. Kaplin (Argonne National Lab., Ill.).

A calibration towing chamber was designed and constructed in order to determine accurate calibration curves for velocity sensing devices in a speed range of from 0.10 to 1.50 fps. Determination of calibration points for hot-wire anemometer probes in the towing chamber between speeds of about 0.10 to 1.60 fps, along with points determined in the wind tunnel for speeds between 0.60 and 7.50 fps, produced a calibration curve that differed from a power law distribution. (M.C.G.)

30187 (ANL-6474(p.82-92)) MULTIPLE REGRESSION ANALYSIS OF SOIL TEMPERATURE DATA. James E. Carson (Argonne National Lab., Ill.).

A series of multiple regression equations was computed to predict the change in soil temperature at 1 cm during a one-hour period at or near the times of maximum increase and decrease of temperature. Six sets of multiple regression equations were prepared. Eight independent variables, each of which is related to a heat-transfer mechanism, were used. The actual calculations were done on an IBM 650 computer. Twenty-four multiple regression computations were made. The simple, partial, and multiple correlation coefficients between each pair of variables are given. Only one independent variable (sunshine) was significant in all four equations for the morning temperature change. Two variables were significant in all three equations for afternoon conditions: air-temperature change and 1-cm soil temperature. The most conspicuous feature of the results was concluded to be the instability of sign, magnitude, and

significance of an independent variable from one year or one study to the next. (M.C.G.)

30188 (HW-SA-2617) EVALUATION OF SKIN DOSE FROM PARTICULATE CONTAMINATION. B. V. Andersen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 31, 1962. Contract [AT (45-1)-1350]. 13p.

An autoradiographic technique for evaluating the magnitude of the radiation dose to the skin from a point source of contamination on clothing is used at Hanford. The application of a scanning microdensitometer for evaluation of the autoradiograph and the geometrical model used to estimate the skin dose are discussed. The errors inherent in the final dose estimation are shown. Some of the problems encountered in an analysis of the significance of the assigned dose in relation to permissible limits are summarized. (auth)

30189 (TID-12706) INTERCELLULAR TRANSFER OF FORSSMAN HEMOLYSINS DURING THE COURSE OF INITIAL AND SECONDARY IMMUNIZATIONS AND AFTER SEPARATION BY STARCH ELECTROPHORESIS. William H. Taliaferro and Lucy Graves Taliaferro (Argonne National Lab., Ill.). Mar. 1961. Contract [W-31-109-eng-38]. 24p. (UAC-5114)

The net intercellular transfer of rabbit hemolysins in normal serums as well as in serums resulting from one injection or reinjection of sheep red cells or heated sheep red cell stromata was determined using Cr^{51}-labeled red cells as an indicator. Starch zone electrophoresis was carried out on whole serums that had been frozen 203 months. Applications of the method in studies of the avidity of hemolysins, or the firmness of antigen-antibody binding, are discussed. (C.H.)

30190 (AEC-tr-5142) USE OF RADIOISOTOPES AND RADIATION IN THE FIELD OF PLANT PROTECTION. S. V. Andreev, B. K. Martens, and V. A. Molchanova. Translated from p.23-37 of "Proceedings of the Symposium on Radioisotopes and Radiation in Entomology, held in Bombay, December 5–9, 1960." (a publication of the International Atomic Energy Agency, Vienna, 1962. (STI/PUB/38(p.23-37)). 19p.

Extensive investigations are being carried out in the Soviet Union on applications of radioisotopes and ionizing radiation in the control and elimination of insects and microorganisms that attack plants of agricultural interest. Isotopes have been used as tracers to follow the movements of pests and parasites, to define reservoir areas, to determine population size, food cycles, and to establish predatoriness and parasitism among insects, to follow the movement of insecticides within plants and within plant pests, to make a comparative evaluation of toxic agents having a systemic action, and to ascertain the duration of the toxic characteristics of such agents in plants and agricultural produce. The effects of ionizing radiation on microorganisms, seeds, and insects were studied and a gamma irradiation facility was designed for the control of insect pests in stored grains and other seeds. (C.H.)

30191 INFLUENCE OF RETICULOENDOTHELIAL HYPERFUNCTION ON BONE MARROW TRANSPLANTATION. W. R. Wooles and N. R. di Luzio (Univ. of Tennessee Medical Units, Memphis). Am. J. Physiol., 203: 404-8(Sept. 1962).

Reticuloendothelial (RE) hyperfunction was induced in C_{57}/BL mice by the administration of trypsinized zymosan or glucan. The exposure of RE hyperfunctional mice to 800 r whole-body x-irradiation produced no change in phagocytic activity as denoted by the intravascular removal rate of colloidal carbon. The saline-injected control group showed a significant impairment in RE phagocytic activity. Reticuloendothelial hyperfunction existing at the time of bone marrow transplantation did not alter the high degree of recovery from radiation exposure afforded by isologous bone marrow transplantation. However, survival in RE hyperfunctional animals appeared to be correlated to the genetic diversity of the transplanted marrow since RE hyperactive animals receiving the homo- or heterografts manifested a 100% mortality as opposed to a 30-day survival of 90% and 25% in the respective saline-treated irradiated mice. These findings demonstrate that the early acceptance or rejection of the transplant is influenced by the functional state of the RES and the genetic variation of the transplant. (auth)

30192 TRIATED BILIRUBIN: PREPARATION AND PHYSIOLOGICAL STUDIES. Gerold M. Grodsky, John V. Carbone, Rudolph Fanska, and C. T. Peng (Univ. of California, San Francisco). Am. J. Physiol., 203: 532-6(Sept. 1962).

A procedure is described for the preparation of tritiated bilirubin by the Wilzbach technique, either directly (preparation W) or in conjunction with irradiation from a Co^{60} source (preparation C-W). After equilibration of the preparations with polar and nonpolar solvents to remove labile tritium and repeated precipitation, the constant specific activities were 110 μc/mg (W) and 30 μc/mg (C-W), respectively. Radiochemical purity of the bilirubin-H^3 preparations and their azobilirubin-H^3 derivatives was demonstrated by paper chromatography. Bilirubin-H^3 and a high dose of carrier bilirubin were injected simultaneously into rats and the comparative bilirubin levels in serum and bile were determined by radioactivity and colorimetric methods. After 75 min, 20 to 30% of the initial label remained in the serum as nonbilirubin radioactivity. Pre-equilibration in vitro of bilirubin-H^3 with albumin removed the protein-labile tritium. It was concluded that the adsorption of bilirubin to serum protein may involve hydrogen binding at an aliphatic group on the bilirubin molecule. In serum and bile the distribution of the bilirubin-H^3 (pre-equilibrated with albumin in vitro) was identical to the distribution of bilirubin measured colorimetrically. The half-life for disappearance of bilirubin from serum in these rats was 25 to 35 min. (auth)

30193 DYNAMICS OF CELL PROLIFERATION IN THE BONE MARROW OF IRRADIATED MICE, USING CERTAIN FACTORS WITH A PROTECTIVE EFFECT. Z. Karpfel, V. Dráždil, and M. Skalka (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague), 8: 152-8(1962). (In English)

Cell proliferation was studied in the bone marrow of irradiated mice in relation to the use of certain protective factors. The mitotic index, the incidence of chromosomal aberrations and the proportion of individual mitotic figures were studied. The protective effect of cysteine and artificial hypothermia was manifested in all the given mitotic indicators. In experiments with homologous bone marrow, the optimal interval between irradiation and bone marrow transplantation was determined. The results showed that proliferation of the injected bone marrow was not satisfactory if the interval was longer than 24 hours. The hypothesis that homologous bone marrow undergoes a change in an irradiated host, resulting in abnormal mitosis, was submitted. The finding of an increase in the number of metaphases in the dividing bone marrow cell population at a given interval after irradiation was reverified. This anomaly is due to the direct effect of radi-

ation on bone marrow and was not observed after other forms of stress. (auth)

30194 A TECHNIQUE FOR WITHDRAWAL OF STRONTIUM FROM BODY OF EXPERIMENTAL ANIMALS. Kai Setaelae (Univ. of Helsinki). Naturwissenschaften, 49: 302-3(1962). (In English)

A withdrawal technique based on the artificially induced deficiency in Sr concentration in a peripheral fluid compartment (salivary glands) was used to measure the Sr equilibrium in the peripheral fluids. Mice and cats were used as the experimental animals, and the results showed that neither Sr^{85} + Sr^{89} nor Sr were per se irreversible "bone-seeking" compounds. Administration of pilocarpine nitrate always resulted in a removal in the saliva flow of large quantities of both Sr^{85} + Sr^{89} and Sr without provoking a Ca leakage. Administration of parathyroid extract significantly increased the concentration of blood Sr, but its effect on Ca was inconsistent. Injection of pilocarpine nitrate, after a short-time exposure of the animals to parathyroid extract, resulted in a departure of Sr and Sr^{85} + Sr^{89} in the saliva. The administration of ammonium chloride to cats caused a high-degree renal leakage of Ca. (J.S.R.)

30195 NEUTRON ACTIVATION ANALYSIS FOR PHOSPHORUS IN A STUDY OF DEVELOPMENT IN A BEETLE WING. James S. Beck and Thomas R. Manney (Univ. of California, Berkeley). Science, 137: 865-6(Sept. 14, 1962). (UCRL-10389)

Neutron activation analysis was used to measure phosphorous in individual beetle wings during pupal and early adult stages. By counting neutron-induced P^{32} radioactivity it was possible to measure 0.005 ± 0.001 μg of phosphorus. The phosphorus content of the wings rises to maximum at eclosion and subsequently decreases with loss of cells. (auth)

Biochemistry, Nutrition, and Toxicology

30196 (HW-SA-2614) STUDIES WITH NEPTUNIUM IN THE RAT. John E. Ballou, William J. Bair, Arthur C. Case, and Roy C. Thompson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [May 25, 1962]. Contract AT(45-1)-1350. 11p.

Results are reported from preliminary studies on the hazard potential of Np^{237} in rats. Some of the experiments were performed with a dust that consisted principally of Al, Fe, and U, with Np^{237} present to the extent of about 0.03% by weight. Data are tabulated on the inhalation of this dust. Since Np^{237} has a half life of 2.2 million years, chemical rather than radiation toxicity is indicated in the acute case and metabolic studies with Np^{237} may be hampered by toxicity problems. Data are presented on the 24-hr retention of gavage-fed carrier-free Np^{237}, administered as the citrate and as the nitrate, and short-term studies of tissue deposition. Results show that Np is concentrated in bone, liver, and kidney during the period immediately following administration. (C.H.)

30197 (HW-SA-2688) RELATIONSHIPS BETWEEN THE CONCENTRATION OF RADIONUCLIDES IN COLUMBIA RIVER WATER AND FISH. R. F. Foster and Dan McConnon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 25, 1962]. Contract AT-(45-1)-1350. 24p.

The uptake of radionuclides by fish is a function of a number of interacting factors which results in wide variability. This variability is sufficiently great so that a large number of samples collected over at least one year's time is necessary in order to determine the average concentration in the fish and fluctuations with time, at least in the case of radionuclides with relatively short effective half-lives. Concentration factors derived on theoretical basis which assume a high rate of intake by the fish throughout the year will substantially overestimate the quantities of radionuclides which will accumulate in the fish. This generalization should hold for radionuclides with effective half-lives of several weeks or less in ecological conditions subject to wide variations between seasons. (auth)

30198 (TID-16577) EXCRETION AND RETENTION OF Se^{75} IN RELATION TO MODES OF ADMINISTRATION, TOXICITY, AND PREGNANCY. Final Report. Irene Rosenfeld (Wyoming. Univ., Laramie). [1962]. Contract AT(11-1)-630. 22p.

Selenium retention in tissues and excretions were studied in rats by the use of tracer amounts (7.5 μg Se) of selenite-Se^{75}. The selenium was given intraperitoneally, intragastrically, and subcutaneously. Data on the elimination of selenium by urinary, gastrointestinal, and respiratory tracts are given. The administration of repeated chronic toxic doses (2.5 Se mg/kg) increased the selenium retention in the blood and kidney, and large amounts of Se^{75} were present in the intestinal tract. Functional damage to the kidney and gastrointestinal tract was produced in chronic selenosis. The biological half life of Se^{75} in the tracer (atoxic) group was 0–24 hours, and in the toxic group was 48 or 72 hours. Data on tissue retention and excretion of Se^{75} in urine, feces, and respiratory tract in chronic selenosis are presented along with placental transmission of Se^{75} and distribution of retained Se^{75} in the fetuses and maternal tissues subsequent to repeated administration of chronic toxic and tracer doses of selenium. The retained selenium is metabolically active and released slowly from tissues. (auth)

30199 ^{75}Se IN RAT INTRACELLULAR LIVER FRACTIONS. Kenneth P. McConnell and D. M. Roth (Veterans Administration Hospital, Louisville, Ky. and Univ. of Louisville, Ky.). Biochim. et Biophys. Acta, 62: 503-8(Aug. 27, 1962).

Liver-cell fractionation studies showed Se^{75} present in all the fractions after subcutaneous injection. The uptake of total Se^{75}, representing protein and non-protein bound, was greatest in the soluble fraction, followed by the mitochondria, the microsomes and the nuclei, respectively, over time intervals ranging from 15 min to 3 weeks. In terms of protein-bound selenium per unit of nitrogen, the greatest initial Se^{75} concentration was found in the microsomal fraction. A significant amount of the microsomal selenium was present in the ribonucleoprotein fraction. A possible intracellular-metabolic pathway for the incorporation of selenium into the various intracellular liver fractions is presented. (auth)

30200 TRANSITION OF Sr^{90} TO THE PROGENY IN RATS AFTER SINGLE INTRAPERITONEAL ADMINISTRATION. M. A. Levchenko and Yu. D. Parfenov. Med. Radiol., 7: No. 8, 74-8(Aug. 1962). (In Russian)

The quantitative regularities of Sr^{90} transition in rats to the progeny via the placenta during pregnancy and with the milk during nursing following single intraperitoneal introduction of the isotope to the mother in a dose of 0.4 mC/g were studied. Determinations were made of the radioactivity in the progeny of three generations of rats at different periods after isotope administration. On the basis of experimental data, calculations were made of adsorbed tissue

doses in rats received by the maternal skeleton and the progeny. (auth)

30201 BIOCHEMICAL AND CHEMICAL STUDIES ON ASTRAGALUS LEAVES AND ROOTS. 1. ENZYMATIC; 2. TRANSLOCATION OF Se^{75} WITH RADIOAUTOGRAPHS; 3. ABSORPTION AND EXCHANGE OF Se^{75} IN ROOT SEEDLINGS. Bulletin 385. (Wyoming. Agricultural Experiment Station, Laramie). 43p.

Studies on the enzymatic mechanism in respiration of the leaves of Astragalus racemosus suggest that the respiration is mediated by a cycle similar to, if not identical with, the Krebs citric acid cycle. Analysis of leaves, stems, and roots of A. bisulcatus grown in soil containing Se^{75} and K_2SeO_4 indicated that not all parts of the plant contain the same amount of Se. The roots, as they absorb Se from the soil, do not store it but translocate it to the aerial parts of the plant. Radioautographs of the leaves indicated that there is a definite relation between metabolic activity and presence of Se in the plant. A method for the fractionation of leaf protoplasm and chloroplasts was developed for A. bisulcatus. Factors influencing the separation are discussed. The distribution of Se^{75} indicated that Se does not occur in firm combinations with the proteins of the chloroplasts. Most of the Se^{75} was present in the cytoplasmic fractions. Root seedlings of A. preussii contained a high concentration of Se and absorption of radioactive Se was mainly through active absorption and ionic exchange for the Se present in the roots. Live roots at 25°C attained ionic equilibrium at a rapid rate. At 0°C both live and dead roots failed to establish equilibrium between the roots and the exchange solution. Live root skeleton bound more than 10% of the Se^{75} which was not acid extractable. About 1% of the Se^{75} was bound in the dead root skeleton, and this was not removed during extraction. (P.C.H.)

Fallout and Ecology

30202 (NP-12006) SUMMARY OF THE OBSERVATION RESULTS FOR DEPOSITION OF RADIOACTIVITY IN THE WORLD DURING IGY-IGC. (Japan. Meteorological Agency, Tokyo). Mar. 1961. 145p.

Data are tabulated on levels of airborne radioactive fall-out, with emphasis on Sr^{90}, in samples of air and rain water collected throughout the world during 1958, 1959, and 1960. Brief papers are included on the influence of the atomic explosion in the Sahara Desert, physical aspects of fall-out in the troposphere, and gross radioactivities of the sea near Japan. (C.H.)

30203 A THEORETICAL CONSIDERATION OF RADIOACTIVE INTENSITY IN THE AIR. Kiyoshi Seya. Chishitsu Chosasho Geppo, 13: 1-16(Jan. 1962). (In Japanese)

Equations are given for the relationship between air radioactivity and altitude, and topographic and geological influences are discussed. Abnormal relations between radioactivity and altitude were found in the airborne radiometric surveys carried out in southern Yamaguchi in March and Sept. 1957. These abnormal relations and possible causes are studied, and a procedure is given for treating airborne survey data. (D.L.C.)

30204 THE MAIN PATHWAYS OF THE MIGRATION OF STRONTIUM-89 IN BENTHOS-FEEDING FISH IN FRESH-WATER RESERVOIRS. G. D. Lebedeva. Radiobiologiya, 2: 43-9(1962). (In Russian)

The migration of radioactive strontium from contaminated water and feed of invertebrates (larvae of Chironomidae) into the organism of benthos-feeding freshwater carp was investigated for the purpose of determining whether the radioisotopes enter the fish through the food or the water. The experiments were carried out under controlled conditions in 3 aquaria during a one-year period with Cyprinus carpio. The first aquarium contained pure water, feeding the fish with materials containing radioactive Sr; the second contained contaminated water, the fish being fed with pure food while both the water and the food were contaminated in the third aquarium. As radioactive material, $Sr^{89}Cl_2$ was used, keeping the activity of the water at $(5 \pm 0.57) \cdot 10^{-7}$ curie/liter and that of the feed material at $(7.6 \pm 1.5) \cdot 10^{-7}$ c/kg. The results confirmed the expectation that Sr^{89} follows the same path as Ca^{45}; it enters the carp primarily from the water and not through the food chain. (TTT)

30205 BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY, NO. 27, OCTOBER-DECEMBER, 1961. Tokyo, The Japan Meteorological Agency, 1961. 100p. (In English and Japanese)

Radioactivity measurements in Japan during Oct. to Dec. 1961 are reported for U_3O_8 standard samples, rain collected at fixed time daily, initial 1 mm of rain, rain water, and dusts. (D.L.C.)

Radiation Effects on Living Tissues

30206 (AED-BRD-C-04-3) EINWIRKUNG IONISIERENDER STRAHLEN AUF LEBENDES GEWEBE UND ORGANISMEN. BIBLIOGRAPHISCHE ZUSAMMENSTELLUNG. (Effects of Ionizing Radiation on Living Tissues and Organisms. Bibliographical Collection). Irmgard Wensel-Wolf (Gmelin-Institut fur Anorganische Chemie und Grenzgebiete, Frankfurt am Main). Jan. 1, 1961. 130p.

References (592) are given to reports, journals, and books published from 1955 to 1960. Separate author and subject indexes are included. (P.C.H.)

30207 (BNL-4905) THERAPIE MIT NEUTRONEN. Lee E. Farr and James S. Robertson (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT-30-2-GEN-16]. 89p.

Neutron capture therapy was developed for treating neoplasms. It involves the introduction of a neutron-capturing target material into the tumor followed by exposure of the tumor to a cloud of thermal neutrons. The only target material used in patients was B^{10}, although other nucleides were considered. The boron was administered intravenously as the pentaborate and delivered to the tumor by circulation. The BNL Medical Research Reactor was used as the source of thermal neutrons. Some 40 patients were treated with a variety of boron and neutron doses and exposure patterns. The treated patients generally showed definite clinical improvement but no patient survived over 18 months after neutron capture therapy. An absence of histological changes attributable to radiation effects in the normal brain indicated that doses of neutrons higher than those which were used may be permissible. (auth)

30208 (HW-SA-2660) DELAYED EFFECTS IN RATS OF CHRONIC YTTRIUM-90 INGESTION. M. F. Sullivan, S. Marks, and R. C. Thompson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 6, 1962]. Contract AT(45-1)-1350. 12p.

Mature female rats were maintained for 60 days on drinking water containing Y^{90}. A high-level group of 50 animals ingested an average of 410 μC/day; a low-level group of 50 animals ingested 90 μC/day. Nine animals from the high-level group died during the exposure period,

all of which experienced severe weight loss. The low-level group exhibited no gross symptoms during the exposure period to distinguish them from the controls. The total accumulated beta-ray dose to the large intestine was estimated at about 55000 rads in the high-level group and about 12000 rads in the low-level group. Median post-treatment survival times were 350 days for the high-level group, 434 days for the low-level group, and 626 days for control animals. Late effects of particular note in the exposed groups included cancerous involvement of the oral cavity and reproductive organs. Numerous corneal ulcers were probably related, in part at least, to external contamination. Histopathologic study of the intestinal tract indicated virtually complete recovery of early damage, and only one intestinal tumor was observed among the exposed animals. (auth)

30209 (HW-SA-2696) X-RAY EFFECTS ON SINGLE AND MIXED SPECIES POPULATIONS OF TRIBOLIUM CONFUSUM AND TRIBOLIUM CASTANEUM (COLEOPTERA: TENTEBRIONIDA). H. E. Erdman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 24, 1962]. Contract AT-(45-1)-1350. 8p.

A difference in radiosensitivity of Tribolium confusum and Tribolium castaneum was found following exposure to doses of 2 to 6 kr x radiation. Reproductive capacity and individual weights were used as a criteria of radiosensitivity. Populations of flour beetles were cultured as single or mixed species. (C.H.)

30210 (NP-12021) PATHOLOGICAL EFFECTS OF THYROID IRRADIATION. A report of a Panel of Experts from the Committees on the Biological Effects of Atomic Radiation; National Academy of Sciences—National Research Council. (Federal Radiation Council, Washington, D. C.). July 1962. 10p.

Therapeutic doses of x rays to the thyroid region of children have been followed after some years by the development of thyroid cancer in a very small proportion of cases. The tumor incidence is not demonstrably dose dependent, but it exceeds that found in unirradiated children. X rays are more effective than iodine-131 in producing thyroid cancer, for equal energies delivered to the gland. The induction of thyroid tumor appears to be enhanced by the irradiation of tissues, as yet unidentified, in addition to the thyroid itself. At high dose levels the thyroids of infants and children may be somewhat more susceptible to radiation carcinogenesis than those of adults. Evidence on this point is lacking at very low doses because no cases of thyroid cancer at these levels is known. Radioactive iodine has been shown to be carcinogenic in some animals, but no case of thyroid cancer ascribable to it has been found in man. (auth)

30211 (NYO-2759) THE EPIDEMIOLOGICAL FOLLOW-UP OF THE NEW JERSEY RADIUM DIAL PAINTERS. Progress Report to January 31, 1962. (New Jersey. State Dept. of Health. Radium Research Project, West Orange). Contract AT(30-1)-2181. 248p.

The Radium Research Project of the New Jersey State Department of Health is concerned with the epidemiological follow-up, within the state of New Jersey and metropolitan areas of New York and Philadelphia, of approximately 1,000 former workers in the radium industry with body burdens of Ra^{226} and Ra^{228}. More than 900 have already been identified and the current location and status of about 520 have been established. Of these, about 340 are currently living and 180 are deceased. Approximately 200 cases are currently undergoing comprehensive medical, radiographic, dental, clinical laboratory, and radiological studies; 104 have completed the basic evaluation. Some findings suggesting a relationship to a body burden of radium are now apparent. Defects and changes in the density and trabecular structure of bone are evident from skeletal and oral radiographs. Elevated erythrocyte sedimentation rates and alteration of serum globulin patterns occur frequently. Malignant tumors have been found in 14 of the cases under study. Estimates of body burdens, currently found in the cases studied, range from ≤0.0042 to 1.67μc Ra^{226} and from ≤0.0009 to 0.012μc Ra^{228}. At present, it is difficult to establish a definite correlation between the body burdens of these cases and the incidence of the various changes or pathological conditions observed. Further detailed histopathological and radiological studies may offer clues to causal factors involved. (auth)

30212 (ORINS-41) MEDICAL DIVISION RESEARCH REPORT FOR 1961. (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.). Contract AT-40-1-GEN-33. 62p.

Progress is reported in a number of diverse studies on radiation effects in man and experimental animals. Biochemical, immunologic, and hematologic studies were carried out on patients given whole-body irradiation in low, medium, and high dose ranges. Emphasis was placed on remission in acute leukemia after whole-body irradiation. Results are also summarized from studies on the effects of local port irradiation, with γ radiation from a Co^{60} teletherapy unit, on the peripheral blood and bone marrow in patients; bone marrow lipid levels in animals exposed to whole-body irradiation; liver damage in irradiated animals given bone marrow infusions; nitrogen balance in irradiated chimeras; the effects of injected radionuclides on lipid metabolism; and the effects of stable Ce on liver lipids. A comparative study was made of results using Au^{198}, I^{131}-labeled rose bengal, or I^{131}-labeled serum albumin for liver scanning in patients with liver disease. An in vivo tissue culture system for the propagation of human cells was investigated for use in studies of antibody formation. Investigations are reported underway on the feasibility of using a small South American primate, Tamarinus nigricollis, as a laboratory animal for radiation studies. Special equipment designed for clinical work with radioisotopes is described. A schematic sketch is presented of an apparatus for in vivo $C^{14}O_2$ collection and subsequent scintillation counting. A list is included of publications during the period covered by this report. (C.H.)

30213 (ORO-566) EFFECT OF BETA AND X-IRRADIATION ON FREE OR ORGANIZED GROWTH OF MALIGNANT CELLS AND ON THEIR LOCAL OR METASTATIC SPREAD AND IMPLANTATION. Progress Report, April 1, 1955—March 31, 1962. Horace Goldie (Meharry Medical Coll., Nashville). Contract AT(40-1)-1993. 25p.

The mechanisms of processes involved in growth and spread of malignant cells within the peritoneal and pleural cavities, and their response to various applications of radiation were investigated in mice and rats. The copious exudation of serous fluid, free growth in this fluid of tumor cells, and their local and systemic spread into tissues were determined. Radiation sources included short-lived pure β emitting radioisotopes, such as P^{32} chronic phosphate; Ag^{111} oxide, chloride, or phosphate; or Y^{90} chloride and phosphate, all in colloidal preparations, and a therapeutic x-ray unit. Growth of the malignant cells and their spread were shown to be two relatively independent, but closely associated, phenomena. Data are summarized on the response of malignant cells to irradiation in various combinations of external and internal exposure and pre- and post-injection treatments. A list is included of publications covering various aspects of this study. (27 references.) (C.H.)

30214 (TID-6875) PITUITARY CHANGES IN PARABIOSED AND IRRADIATED RATS. Shields Warren and Tamaki Imai (New England Deaconess Hospital. Cancer Research Inst., Boston). [1959]. Contract AT(30-1)-901. 4p.

After parabiosed rats became stabilized, the right-hand rat received 1000 r of 250 kv x radiation and the left was shielded. The pituitary glands of both animals were subject to the hormonal stimuli received from the irradiation. Forty female parabiont pairs with one rat irradiated lived an average of 505 days, of which 383 were after irradiation. Thirty-four male parabiont pairs lived an average of 506 days, of which 394 were after irradiation. Diffuse hyperplasia and tumors of the pituitary were restricted to the females. Hyperplasia occurred frequently among them. (P.C.H.)

30215 (TID-12089) A THEORY OF THE IMPROVED PERFORMANCE AND SURVIVAL PRODUCED BY SMALL DOSES OF RADIATIONS AND OTHER POISONS. George A. Sacher and Ernesto Trucco (Argonne National Lab., Ill.). Nov. 1960. Contract [W-31-109-eng-38]. 15p. (UAC-4739)

Recent evidence of decreased disease incidence and increased expectation of life in irradiated populations of insects, mice, and rats are reviewed. Observations on irradiated populations and controls led to the inference that the damaging effects of ionizing radiations were manifest even in the groups showing oversurvival and that the improved survival resulted through mechanisms independent of those causing the deleterious actions. It was observed that the variability of survival time from subgroup to subgroup is less than in the controls. It is concluded that this decreased variability among the exposed groups is a fundamental effect of the radiation exposure and the improved mean survival is an occasional consequence of it. A theoretical discussion of this premise is presented. (C.H.)

30216 (TID-12697) I. INTERRELATIONSHIPS OF AGING AND LIVER REGENERATION. II. LIVER REGENERATION IN HIBERNATING AND NON-HIBERNATING GROUND SQUIRRELS. III. EFFECTS OF FURADANTIN AND STREPTOMYCIN ON THE MORTALITY OF IRRADIATED MICE. Lila Williams (Argonne National Lab., Ill.). Jan. 1961. Contract [W-31-109-eng-38]. 39p. (UAC-5046)

Studies in mice showed that the rate of regeneration of liver decreases with age. Hibernation had no effect on the rate of liver regeneration in ground squirrels. Streptomycin was more effective than Furadantin, a bactericidal chemical, in reducing mortality due to bacteremia in irradiated mice. (C.H.)

30217 (TID-16507) A STUDY OF LETHALITY AND PERMEABILITY CHANGES IN IRRADIATED MICROORGANISMS. Annual Progress Report. Alan K. Bruce, Clinton M. Osborn, and Raymond Ewell (Buffalo. Univ.). Aug. 28, 1962. Contract AT(30-1)-2571. 18p.

Preliminary results are reported from studies on the effects of cell extracts from the radioresistant bacterium Micrococcus rubens and from the less radioresistant bacterium Sarcina lutea on the radiosensitivity of Escherichia coli, the effects of various concentrations of p-hydroxymercuribenzoate (HMB) on the radiosensitivity of these three bacteria, the effect of irradiation on K efflux from cells of S. lutea and M. rubens, and the effect of irradiation on the leakage of P^{32}-labeled phosphate compounds from yeast. (C.H.)

30218 (TID-16537) TRANSPLANTATION OF PRESERVED MARROW BETWEEN ANIMALS AND FROM ONE HUMAN BEING INTO ANOTHER, AUGUST 1, 1961-JULY 31, 1962. L. M. Tocantins and Jullios Iossifides (Jefferson Medical Coll., Philadelphia). Contract AT(30-1)-1982. 4p.

Procedures are described for the preservation by freezing of bone marrow, blood platelets, and mouse skin. A procedure for the maintenance of tissue cultures of bone marrow cells is also described. Preliminary results are reported from studies on blood volume in irradiated mice, the effects of high doses of radiation on skin antigenicity and tumorogenesis in mice, and the modification of immune reactions by infection. (C.H.)

30219 (TID-16569) FINAL TECHNICAL REPORT [ON RADIOBIOLOGY] COVERING PERIOD JULY 1, 1954 TO NOVEMBER 30, 1959. James E. Lofstrom (Wayne State Univ., Detroit. Coll. of Medicine). Contract AT(11-1)-307. 30p.

A total of 1806 cases of malignant disease were treated with γ radiation from a Co^{60} teletherapy unit during the period from July 1954 through Nov. 1959. A preliminary evaluation is presented of clinical results. Data are included from measurements of the relative biological effectiveness of Co^{60} γ radiation compared to orthovoltage x radiation. The design and calibration of the teletherapy equipment are described. (C.H.)

30220 (USNRDL-TR-575) LATE EFFECTS STUDIES ON RADIATION-INDUCED HOMOLOGOUS MOUSE CHIMERAS: LONGEVITY AND INCIDENCE OF LEUKEMIA. W. E. Davis, L. J. Cole, W. A. Foley, and V. J. Rosen (Naval Radiological Defense Lab., San Francisco). July 26, 1962. 22p.

In connection with studies on lymphoid cell chimerism and homograft tolerance in long-lived homologous radiation chimeras, data were collected on life span, and on occurrence of leukemia and other lesions. The chimeras were $(C57L \times A)F_1$ hybrid mice (10 to 12 weeks old) exposed to 880 rad of x radiation and injected with bone marrow cells from C3H donors. Out of a total of 119 mice combined from several subgroups, 65% were dead by age 32 weeks, with symptoms of secondary disease evident in the great majority. Relatively few deaths occurred between 32 and 75 weeks, and the maximum life span was 105 weeks. Histopathological data were obtained from many of these long-lived chimeras and also from a group of long-lived isologous marrow chimeras. There was an 80% incidence of glomerulosclerosis of moderate to severe degree, and a 20% incidence of arteriolarsclerosis in the kidney and spleen of the mice in both groups. Leukemias were observed in 5 out of 54 (9%) homologous chimeras, but none was found in the isologous chimera group. Also, two leukemias occurred in 13 chimeras (15%) which had been injected with lymphoid cells obtained from other long-lived homologous chimeras, and thus the progeny of the injected cells have persisted for as long as 80 weeks. The possibility of a causal relationship between secondary disease and the increased incidence of leukemia, as well as the apparent decrease in life span is briefly discussed. (auth)

30221 (AEC-tr-5354) EFFECT OF WHOLE-BODY X-IRRADIATION ON IRON METABOLISM IN ANIMALS. A. B. Uteshev. Translated for Los Alamos Scientific Lab., N. Mex. from Ukrain. Biokhim. Zhur., 34: 371-8(1962). 7p.

Total iron content in different organs and tissues, amount of plasma and readily split-off iron in arterial blood, and the concentration of iron in the blood flowing into and out of the organs and tissues (arteriovenous difference) in whole-body irradiated dogs was studied. The

amount of iron in the liver and spleen increased at the same time that it decreased in bone marrow throughout the entire period of observation. By the fourteenth day the iron content of the kidneys, brain, and muscle increased; it decreased toward the end of the third week after irradiation. On the third day after irradiation all the organs released iron into the blood flowing through them. The release subsequently decreased or gave way to retention. The results indicate profound disruption of iron metabolism and anemia arising in dogs as a result of irradiation. (P.C.H.)

30222 (FTD-TT-62-501) BULLETIN OF EXPERIMENTAL BIOLOGY AND MEDICINE (SELECTED ARTICLES). Translation of Byulleten Eksperimental'noi Biologii i Meditsiny, 53: No. 2, 39-42; 79-84; 94-6(Feb. 1962). 31p.

30223 (FTD-TT-62-501(p.9-16)) EFFECT OF PRELIMINARY RADIOISOTOPE ADMINISTRATION ON THE PERIPHERAL BLOOD COMPOSITION AND THE SURVIVAL OF ANIMALS SUBSEQUENTLY X-IRRADIATED WITH A LETHAL DOSE. P. I. Lomonos. Translated from Byull. Eksptl'. Biol. Med., 53: No. 2, 79-81(Feb. 1962).

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 23443.

30224 (FTD-TT-62-501(p.17-23)) SENSITIVITY OF SKIN CHROMATOPHORES TO IONIZING RADIATION. R. I. Pogosyan. Translated from Byull. Eksptl'. Biol. Med., 53: No. 2, 82-4(Feb. 1962).

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 23444.

30225 (FTD-TT-62-501(p.24-30)) MATURATIVE DIVISION OF OOCYTES IN MAMMALIAN OVARIES AT DIFFERENT STAGES OF THE ESTROUS CYCLE AND IN ACUTE RADIATION SICKNESS. V. Ya. Karmysheva. Translated from Byull. Eksptl'. Biol. Med., 53: No. 2, 94-6(Feb. 1962).

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 23520.

30226 (JPRS-15220) THE EFFECT OF X-RAY ON THE METABOLISM OF FREE NUCLEOTIDES AND ON THE ENZYMES OF NUCLEIC METABOLISM IN AZOTOBACTER AGILE 21-D. G. N. Zaytseva and A. N. Belozerskii (Belozerskiy). Translated from Mikrobiologiya, 31: 209-15 (1962). 10p.

The action of x rays was found to produce a quantitative accumulation of free mononucleotides in Azotobacter agile chiefly at the expense of nucleoside monophosphates. The amount of nucleoside, and especially triphosphates, in irradiated cells of azotobacter sharply decreases. X irradiation leads to the inhibition of oxidizing phosphorylation and to a strong suppression of the activity of the nucleoside phosphokinases, which bring about transphosphorilization among the mononucleotides of the azotobacter. Under the influence of radiation a diminution in the activity of polynucleotide phosphorylase and the activation of ribonucleases is observed, as a result of which there appears a substantial lessening of the quantity of RNA in the studied cells of Az. agile. The strengthening of the activity of DNA-ase under the influence of roentgen radiation is accompanied by a sharp decrease in the quantitative content of DNA in Az. agile. Thus, under roentgen irradiation the action of opposing factors, the inhibiting of nucleoside phosphokinases and of enzymes which synthesize nucleonic acids, on the one hand, and also the activation of nucleases on the other, produces a slowing or cessation of synthesis and a degradation of the nucleonic acids already existing in the cell. X irradiation produces also a direct influence on high-molecular polynucleotides. (auth)

30227 THE EFFECTS OF 200r. OF X-RADIATION IN VIVO ON PHOSPHATE-TRANSFER REACTIONS IN NUCLEI FROM RAT THYMUS GLAND. Margery G. Ord and L. A. Stocken (Oxford Univ.). Biochem. J., 84: 600-1(Sept. 1962).

The radiosensitivity of phosphorylation in nuclei isolated from rat thymus gland was confirmed. Activation reactions which use ATP present in the nuclei at the time of x-radiation were still detectable, and the uptake of ATP by isolated nuclei from irradiated rats were not prevented. Some evidence was presented suggesting that nuclear phosphorylation contributed to the ATP content of nuclei in normal thymocytes. (auth)

30228 THE EFFECT OF ULTRAVIOLET IRRADIATION ON THE ACTIVITY OF A CELL-FREE LIPID SYNTHESIZING SYSTEM. A. Canzanelli, C. Shamoian, and E. J. Pantuck (Tufts Univ., Boston). Biochim. et Biophys. Acta, 62: 497-502(Aug. 27, 1962).

The effects of ultraviolet irradiation on the long-chain fatty acid synthesis by a 105,000 × g supernatant solution obtained from rat liver were studied. As with other component physiological systems it was found to be relatively insensitive to ultraviolet light as compared to whole organisms such as bacteria. The possible site and mechanism of action have been discussed. (auth)

30229 THE EFFICIENCY OF RADIATION PROTECTIVE AGENTS AS A FUNCTION OF THE OXYGEN CONTENT OF THE INHALED AIR AND IN THE TISSUE. E. Ya. Graevskii and M. M. Konstantinova (Severtsov Inst. of Animal Morphology, USSR). Doklady Akad. Nauk S.S.S.R., 145: 195-7(July 1, 1962). (In Russian)

The protective effect of agents which decrease the oxygen tension in tissue (sodium nitrite and adrenaline) and of other agents which have no effect on the oxygen tension in tissue (cystamine and cysteine) were studied at a normal oxygen content and at a high oxygen content of the inhaled air. It is assumed that an increase in oxygen content of the inhaled air would decrease the effectiveness of sodium nitrite and adrenaline as protective agents, and not affect the effectiveness of cystamine and cysteine. White mice 18 to 20 grams in weight were given a dose of 700 r of Co^{60} γ rays in hermetically sealed glass containers with a controlled atmosphere of 21% O_2 or 98 to 99% O. The protective agent was injected subcutaneously in the following doses per animal before irradiation: 3 mg cysteine, 5 mg cystamine, 0.1 mg adrenaline, and 3.5 mg sodium nitrite. The oxygen tension in the spleen of the animal was determined polarographically. The percent survivals increased from 10.7% for the controls to 32 and 39% survival with the use of cysteine and cystamine as protective agents. The percent survivals did not change, when the irradiation was carried out in pure oxygen. The percent survival for adrenaline was 75% on irradiation in 21% O_2, and the survival dropped to 48.4% on irradiation in pure oxygen. With sodium nitrite the percent survival dropped from 45.2 to 29.9% on going from irradiation in 21% O_2 to irradiation in pure oxygen. The polarographic data showed an increased content of oxygen in the spleen on increasing the oxygen concentration in the inhaled air. The protective effect of sodium nitrite and adrenaline is associated with a decrease of oxygen in the tissue, but the protective effect of cysteine and cystamine is not related to the concentration of oxygen in the tissue. (TTT)

30230 THE BIOLOGICAL PROTECTION OF SKELETAL-MUSCLE TISSUE AGAINST INJURY BY IONIZING RADIATION. A. N. Studitskii and M. F. Popova (Severtsov Inst. of Animal Morphology, USSR). Doklady Akad. Nauk S.S.S.R., 145: 198-201(July 1, 1962). (In Russian)

Pulverized muscle tissue transplanted to an open cut car

serve as a protective agent against damage by ionizing radiation. Muscle was removed from both extremities of a white rat, and was cut up with scissors. Part of the ground muscle was put back in the cut. Numerous previous experiments showed that regeneration of muscle tissue in this type of cut was impossible without introduction of the pulverized muscle tissue. The regenerating muscle tissue was then given a local x-ray dose of 2000 r in 24 hours, 3 days, 7 days, and 21 days after the operation. In the control animals the muscle tissue was removed, subjected to pulverization, and transplanted after the irradiation. The control animals showed the presence of a great deal of connective tissue but only an insignificant development of muscle tissue in the cut. The ground muscle tissue did not show any signs of development in the first few days, but after 3, 7, and 21 days a rapid development of miogenic tissue by mitotic division is observed. The regenerative processes going on in the damaged tissue protect the muscle tissue from damage by ionizing radiation. The regenerating tissue is resistant to radiation damage, and continues its development without noticeable deviation from the norm. (TTT)

30231 CHANGES IN THE IMMUNOLOGICAL REACTIVITY OF NEWBORN RATS FOLLOWING THE ADMINISTRATION OF IRRADIATED AND NON-IRRADIATED MOUSE BLOOD CELLS. Věra Poessnerová. Charles Univ., Prague). Folia Biol. (Prague), 8: 159-67(1962). (In English)

In two series of experiments, newborn rats were treated with mouse blood cells for eight weeks. After immunization with the same blood cells in adult life, a highly significant decrease in heteroagglutinin formation was found. When the same blood cells, pre-irradiated with a dose of 20,000 r, were used to induce tolerance, a much smaller, but still significant decrease in the heteroagglutinin titre was obtained. The difference between the degree of tolerance obtained by irradiated and not irradiated blood cells was significant. Tolerance induced by irradiated blood cells was highly significant even after an interval of 12 weeks and after reimmunization. In a similar experiment, native human blood cells induced approximately the same degree of tolerance as native mouse cells. The runting syndrome developed in two rats tolerant to human blood cells, but there are some doubts as to its aetiology. (auth)

30232 ON THE QUESTION OF POSTIRRADIATION INJURY OF ERYTHROCYTES IN PERIPHERAL BLOOD. J. Karásek and M. Skalka (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague), 8: 173-7(1962). (In English)

A study was made on the rate of hemolysis of the erythrocytes of non-irradiated and irradiated rats incubated in plasma and spleen or liver homogenate from non-irradiated and irradiated rats. Under the given experimental conditions no injury to the erythrocytes in the peripheral blood and no release of hemolytic substances in the irradiated organism were demonstrated. (auth)

30233 PERMEABILITY CHANGES IN THE RAT MESENTERIC MEMBRANE AFTER X-RAY IRRADIATION IN VITRO. M. Pospíšil and Jarmila Dvořáková (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague), 8: 178-81(1962). (In English)

Day's method was used to study the permeability of the rat mesenteric membrane for saline solutions. It was found by repeated measurement that permeability decreased proportionately to the time of exposure to hydrostatic pressure on the membrane and that it was dependent on the pH of the solution. Changes in permeability was explained on the basis of changes in the swelling of the colloid system of the membrane. After irradiation with a dose of 5,000 r in vitro, changes in the permeability of the mesentery were observed, which were evidently due to stimulation of the swelling process. (auth)

30234 THE URINE SODIUM/POTASSIUM RATIO AND ITS RELATIONSHIP TO THE DEGREE OF RADIATION THYMOLYSIS IN RATS. M. Pospíšil (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague), 8: 182-5(1962). (In English)

An attempt was made to utilize variations in the urine Na/K ratio in the differentiation of interindividual differences in the degree of thymolysis in starving rats irradiated with a dose of 300 r. Three days after irradiation the wet and dry weight of the thymus showed an unstraightforward relationship to Na/K values obtained before and after irradiation. Extreme values in the range of the Na/K ratio were accompanied by the highest degree of thymolysis. The methodological and prognostic significance of this finding is stressed. (auth)

30235 THE APPEARANCE OF NEW PROTEINS IN THE SERUM OF IRRADIATED RABBITS. Š. Paulov (Comenius Univ., Bratislava). Bolia Biol. (Prague), 8: 186-9(1962). (In English)

The appearance is reported of new proteins X in rabbit serum after a single whole body dose of 1100 r gamma radiation Co^{60}. (auth)

30236 THE EFFECTS OF RADIATION DAMAGED HETEROCHROMATIC CHROMOSOMES ON MALE FERTILITY IN THE MEALY BUG, PLANOCOCCUS CITRI (RISSO). Walter A. Nelson-Rees (Univ. of California, Berkeley). Genetics, 47: 661-83(June 1962).

Male mealy bugs, Planococcus citri (Risso), were exposed to various doses of gamma rays (15–90,000 rep), mated to stock females, and the morphology, cytology and fertility of the surviving sons (X_1) studied. There was a pronounced lethality of sons as well as daughters in cultures following paternal treatment above 15,000 rep. Survivors in these high dosage cultures developed more slowly than individuals in control matings. No external phenotypic changes appeared in any of the X_1 males studied. Findings are summarized. The effects of high dosage paternal irradiation on the fertility of the sons are discussed in terms of the possible functions of the heterochromatic chromosomes of the lecanoid male. (C.H.)

30237 EMBRYONIC LETHALS INDUCED BY X-IRRADIATION OF FIRST MEIOTIC METAPHASE OOCYTES OF HABROBRACON. Gertrude Heidenthal (Russell Sage Coll., Troy, N. Y.). Genetics, 47: 685-93(June 1962).

Two methods were used to study the frequency of various kinds of lethals induced by x irradiation of Habrobracon oöcytes in first meiotic metaphase. The methods are described and results are reported. (C.H.)

30238 GENETIC ANALYSIS OF RADIATION RESPONSE IN ESCHERICHIA COLI. Howard I. Adler and James C. Copeland (Oak Ridge National Lab., Tenn.). Genetics, 47: 701-12(June 1962).

An analysis of a cross between Escherichia coli K-12 strains of different radiation sensitivities was made. The data indicate that hereditary determinants of radiation behavior are transferred during bacterial conjugation, the difference in radiation sensitivity in the parental strains is a multigenic phenomenon, genes capable of affecting x-ray survival can also affect UV survival, and the genes involved may be located somewhere between proline and histidine on the E. coli linkage map. The results are discussed in relation to data available for organisms derived from E. coli B. (auth)

30239 RADIOSENSITIVITY OF DEVELOPING REPRODUCTIVE CELLS IN FEMALE COCHLIOMYIA HOMINIVORAX. Leo E. LaChance and Ann P. Leverich (Agriculture Research Service, USDA, Kerrville, Tex.). Genetics, 47: 721-35(June 1962).

In female Cochliomyia hominivorax, radiation-induced dominant lethal changes in the reproductive cells (which develop synchronously) were measured by egg-hatchability tests and correlated with cytological observations of the stage of nuclear development. In pupae 4 to 6 days old, only oogonial cells are present. Irradiation at this age reduced the number of mature oocytes produced as the dose increased, but the lowered hatchability of eggs that were produced indicated that some dominant lethals persisted through maturation to be detectable in the embryo. In old pupae and newly eclosed adults, differentiation of the oocytes and nurse cells takes place. Irradiation of adults less than 24 hours old interfered considerably with egg production; the younger the female at irradiation, the fewer normal eggs were produced. Irradiation of females older than 24 hours resulted in production of normal numbers of eggs. In three-day-old females the oocyte nucleus is in prophase I, in four-day-old females metaphase I, and in five-day-old females anaphase I. Dosage-response studies indicated that the LD_{50} radiation dose for oocytes in metaphase I is 1,309 r, anaphase I, 1,639 r, and prophase I, 7,939 r. For oocytes irradiated in the first meiotic division, the relation between dose and dominant lethals induced was linear for the range investigated. (auth)

30240 A FACTOR IN THE SERUM OF IRRADIATED RATS STIMULATING LYMPHOID TISSUE MITOSIS. Yoichiro Ito and Fay B. Weinstein (Cleveland Metropolitan General Hospital). J. Natl. Cancer Inst., 29: 229-37(Aug. 1962).

A new technique is described, with which it has been possible to demonstrate a factor in the sera of lymphopenic irradiated rats which appears to act directly upon lymphoid tissue to stimulate mitosis. The method involves comparison of the mitosis density in the popliteal lymph node draining the site of injection of test material with that in the contralateral node. It is felt that this may be a valuable technique for the further investigation of the mechanisms of lymphocyte homeostasis. (auth)

30241 STUDIES ON THE THYMUS OF THE MAMMAL. XIII. HISTOCHEMISTRY OF IRRADIATED THYMUSES OF C57BL STRAIN MICE. Cristianna Smith (Mount Holyoke Coll., South Hadley, Mass.). J. Natl. Cancer Inst., 29: 375-87(Aug. 1962).

In the thymuses of strain C57BL mice, which had previously received 4 doses of 168 r at weekly intervals, sites of alkaline phosphatase activity appeared in parts of the cortex or thoughout whole lobes in contrast to the normal condition of the thymus of this strain in which cortical lymphocytes are negative. Data include results of examination of 97 thymuses (187 lobes) at 10, 20, 30, 40, 50, 60, 80, and 100 days after the last exposure. The incidence, extent of activity, and strength of reaction increased with the length of time. Some of the 100-day group of thymuses were negative and were considered past the active phase. In one series of mice, one group was shielded and one was not; the percentage of normal lobes in the unshielded group was 43, the reactive, 50, and the negative, 2; in the shielded group, the normal was 90, the reactive, 10. The similarity between incidence and the characteristics of the regions of phosphatase activity and those present in the development of lymphomas in thymuses of C57BL mice after the same treatment suggests a relationship. (auth)

30242 EFFECT OF ULTRAVIOLET RADIATION ON THE INCORPORATION OF RADIOACTIVE PHOSPHORUS IN GROWING AND NON-GROWING CELLS OF VIBRIO CHOLERAE. N. K. Kapoor, P. Sagar, and S. C. Agarwala (Central Drug Research Inst., Lucknow, India). J. Sci. Ind. Research (India), 21C: 225-7(1962). (In English)

The incorporation of P^{32} in Vibrio cells is stimulated by glucose and inhibited by chloromycetin, dinitrophenol, azide, and copper ions. In the trichloracetic acid-insoluble fraction, P^{32} is shared mostly by phospholipids and nucleic acids. Larger doses of ultraviolet radiation are required to inhibit the P^{32} incorporation in the nongrowing cells. Incorporation of P^{32} in the growing cultures, however, is affected even at lower doses, and the effect is more pronounced in the DNA fraction. It was suggested that P^{32} incorporation may be through macromolecular turnover in the nongrowing cells, which appears to be relatively insensitive to ultraviolet irradiation as compared to the net synthesis in the growing cultures. (auth)

30243 CHANGES OF THE CELL IMMUNITY IN CHRONIC ACTION OF IONIZING RADIATION. P. N. Kiselev and P. A. Buzini (Central Scientific-Research Inst. of Medical Radiology at the Ministry of Health, USSR). Med. Radiol., 7: No. 8, 59-65(Aug. 1962). (In Russian)

The continuous effect of radiocobalt (Co^{60}) on cell immunity was studied. The data show that chronic irradiation in low doses disturbs cell immunity. Confrontation of disturbances of the humoral and cell immunity divulged that they occur simultaneously in the irradiated organism. The phase of inhibition is preceded by the phase of stimulation. (auth)

30244 REPRODUCTION OF MORGAN'S TOXINFECTION IN MONKEYS AGAINST THE BACKGROUND OF ACUTE RADIATION SICKNESS. L. A. Yakovleva, B. A. Lapin, and S. M. Pekerman (Inst. of Experimental Pathology and Therapy, Academy of Medical Sciences, USSR). Med. Radiol., 7: No. 8, 65-8(Aug. 1962). (In Russian)

Artificial infection of 10 monkeys (Macaca rhesus) with Morgan's bacillus (which is conditionally pathogenic for monkeys) did not provoke the development of the disease. Infection of 7 monkeys with Morgan's bacillus after total x irradiation with a sublethal dose (300 r) caused the development of a severe process in 6 animals which, as in spontaneous affection, ran a course typical of acute gastroenteritis. Two monkeys died. Irradiation influenced the morphological manifestation of the disease in the form of atrophic phenomena in the spleen and lymphatic system of the intestine. (auth)

30245 THE REMOTE SEQUELAE OF INHALATION AFFECTION OF DOGS WITH A MIXTURE OF PRODUCTS OF URANIUM FISSION. B. A. Markelov, S. I. Krotova, E. V. Erleksova. Med. Radiol., 7: No. 8, 69-74(Aug. 1962). (In Russian)

The results of investigations performed in 3 dogs surviving for more than 6 years after a single 5-minute inhalation of air containing a finely dispersed vapor of uranium fission products are given. The experimental dogs developed a chronic radiation sickness. The protracted internal effect of ionizing radiation provoked dystrophic changes in the internal organs (heart, liver, and kidneys) and the development of malignant tumors in the skeleton and other organs. The highest content of beta-active substances was found in the skeleton and the lowest in the liver. (auth)

30246 AN APPARATUS FOR THE AUTOMATIC EXPOSURE OF SMALL BIOLOGICAL SPECIMENS TO RADIATION. C. M. Leach (Oregon Agricultural Experiment Station, Corvallis). Radiation Botany, 2: 1-6(Aug. 1962).

An apparatus for automatically exposing small biological specimens to long exposures of monochromatic electromagnetic radiation, with exposures ranging from a minimum of 10 sec to a maximum of several days or more, essentially consists of: a motor driven disk that holds eighteen specimens and which automatically rotates and stops so that each specimen is irradiated; a timing mechanism which controls the rotation of the disk; this consists of a moving tape (16 mm movie film) in which are punched holes that activate microswitches; the speed of movement of the tape is controlled by different combinations of gears; and an automatically operated camera shutter placed directly in front of the monochromator's exit lens, which is coordinated with the rotation of the specimen disk. In addition, a photoswitch is included in the circuit so that the rotation of the specimen disk automatically stops should the monochromator lamp fail. Although this apparatus was designed specifically for monochromatic irradiation of fungi, it would appear to have widespread application for irradiating many forms of biological materials with either electro-magnetic radiation or other forms of radiation. (auth)

30247 PREDICTION OF THE SENSITIVITY OF PLANTS TO CHRONIC GAMMA IRRADIATION. A. H. Sparrow and G. M. Woodwell (Brookhaven National Lab., Upton, N. Y.). Radiation Botany, 2: 9-26(Aug. 1962). (BNL-5932)

Vegetative growth and the integrity of the sexual reproductive process of pines appear to be highly susceptible to damage from ionizing radiation and the genus Pinus includes some of the most radiosensitive plants known. Chronic exposures averaging about 8 months per year for 9 years produced detectable effects on growth of P. rigida at average dose rates as low as 2 r/day. The lethal acute dose for P. strobus seedlings of 600 r also indicates a high radiosensitivity. The principal reasons for the high sensitivities are the large nuclear volume of pines and, for chronic exposures, the long period between production of the meiocytes and the maturation of seed. It is predicted that many other gymnosperms will have a radiosensitivity approaching that of pines. A comparison of the estimated maximum exposure of vegetation from fall-out occurring in New York City in 1958 with the minimum chronic radiation levels known to influence growth and reproduction of Pinus rigida indicates that these levels of fall-out are approximately $\frac{1}{600}$th of the 2 r/day necessary to produce visible morphological effects within several years. A forest stand representative of the Long Island oak-pine forest is currently being irradiated with chronic gamma radiation from about 9500 c of cesium-137 in an effort to provide quantitative estimates of radiation effects at the population and community levels. Present information makes possible the prediction, on the basis of nuclear characteristics, that the first year's exposure will cause selective killing. All trees within 35 m of the source (85 r/day) will die leaving a shrub community dominated by Gaylussacia baccata, probably one of the most resistant of the species present. The pitch pine (Pinus rigida), with its large nuclear volume, is the most sensitive plant present and will probably be killed by the second year at distances up to 75 m (15 r/day). (auth)

30248 THE EFFECT OF 2,4-DINITROPHENOL AND CUPFERRON ON THE PRODUCTION OF CHROMATID ABERRATIONS BY X-RAYS IN VICIA FABA. B. A. Kihlman and G. Odmark (Univ. of Uppsala). Radiation Botany, 2: 27-34(Aug. 1962).

The effect of 2,4-dinitrophenol (DNP) on oxygen consumption and the production of chromatid aberrations by x rays were studied and compared with that of cupferron. The experimental material consisted of lateral root tips of the broad bean, Vicia faba. The x-ray effect at intermediate concentrations of oxygen (7%) was decreased by DNP in concentrations which stimulated respiration (10–20 μm) and increased by DNP concentrations which inhibited respiration (200 μm). The results are in agreement with the idea that there is a respiration-dependent oxygen gradient in the root. At low oxygen tension (2%) cupferron, but not DNP (100 μm), markedly increased the frequencies of aberrations both at high (120 r/min) and at low (6.4 r/min) dose rates. Apparently, the enhancement is due to the inhibitory effect of cupferron on respiration, which would result in an elimination of the oxygen gradient in the root. In an oxygen atmosphere, both cupferron and DNP (100 μm) increased the frequencies of x-ray-induced interchanges at low dose rates. At high dose rates the effect disappeared. It seems likely that DNP and cupferron bring about the increase by inhibiting the production of the energy-rich phosphate needed for the repair of chromosome damage. (auth)

30249 RADIATION INDUCED REVERSIONS OF A WAXY ALLELE IN BARLEY. G. Eriksson (Forest Research Inst., Stockholm and Univ. of Stockholm). Radiation Botany, 2: 35-9(Aug. 1962).

Barley plants homozygous for the waxy allele were irradiated around meiosis of the pollen mother cells with 25, 100, and 400 r γ rays and the frequencies of reversions from the waxy phenotype to the wild type of the pollen were analyzed. The relation between mutation frequency and dose was found to be exponential, which suggests that the mutations were caused both by point mutations and chromosomal aberrations, possibly deletions. A separate analysis of mutation frequencies of pollen from central and lateral spikelets was made. The lateral spikelets, which develop more slowly, gave higher frequencies of mutants than the central spikelets. (auth)

30250 THE USE OF AN IRRADIATION TECHNIQUE IN OAT BREEDING. D. J. Griffiths and T. D. Johnston (Welsh Plant Breeding Station, Aberystwyth, Wales). Radiation Botany, 2: 41-51(Aug. 1962).

In an experiment on the use of a seed irradiation technique for the improvement of oats it was found that heritable changes in quantitative characters, including earliness, straw height, and yield, could be induced. The ease, however, with which such quantitative variants could be isolated varied for the characters studied. It was concluded that the technique was less suitable for characters greatly influenced by environment—for example, yield—and that such a technique is likely to be only of limited use in an oat improvement program compared with the present-day method of hybridization and selection. (auth)

30251 GROWTH REDUCTION, CHROMOSOME DAMAGE AND MITOTIC INHIBITION PRODUCED IN ROOTS OF VICIA FABA BY X-RAYS AND BY TRIETHYLENE MELAMINE. R. Wakonig-Vaartaja and J. Read (Univ. of Adelaide). Radiation Botany, 2: 53-63(Aug. 1962).

Roots of Vicia faba were grown under carefully controlled conditions. Groups were given 186 and 124 r of x rays and tips were fixed at intervals during the next 84 hr. Other groups similarly irradiated grew for the next 11 days to show that the response of the whole lot was normal. Two groups were immersed in triethylene melamine (TEM), 100 μm solution for 1 hr. The tips of one were fixed at intervals in the next 84 hr and the other group allowed to grow during the next 12 days. Other groups were given x-ray doses of 228 and 130 r and allowed to grow, co-existing with the chemically treated roots. Abnormal anaphase cells, cells with micronuclei and mitotic cells were scored in Feulgen stained squashes from all the treatments. By interpolation

of the TEM results between the x-ray results it is shown that the TEM treatment was equivalent to 166 r judged by the effect on growth, and 180 r judged by chromosome damage. The two are equal within the limits of accuracy of the comparison. (auth)

30252 METABOLIC REPAIR OF RADIATION-INDUCED CHROMOSOMAL DAMAGE. A. V. Beatty and J. W. Beatty (Emory Univ., Atlanta). Radiation Botany, 2: 65-9(Aug. 1962).

Chromosomal aberrations of the exchange types induced in the microspores of Tradescantia with 400 r of x radiation delivered at 50 r/min in a helium atmosphere were used as a measure of radiation damage. Materials treated with potassium gluconate, ATP, and glutathione either before or after irradiation showed approximately 40% fewer aberrations than the irradiated controls. Neither doubling the concentrations of chemicals nor increasing the time of treatment gave any further reduction in aberrations. Three experimental temperatures were used with each chemical. The lowest, 0.2°C, when used alone, reduced aberrations to the same extent as the chemicals at 30°C. Any two of the four variables gave some synergistic effect, which was not increased by using all four at one time. In addition, glucose 6-phosphate, 6-phosphogluconate, TPNH, DPNH, and others also proved effective, indicating that the energy for recovery was being obtained through the hexose monophosphate shunt. (auth)

30253 THE CHIMAERIC FORMATION IN AN X_1 PANICLE AFTER IRRADIATION OF DORMANT RICE SEED. H. Yamaguchi (Tokyo Univ.). Radiation Botany, 2: 71-7 (Aug. 1962).

The number of chlorophyll mutants appearing in the progeny was scored at X_2 and X_3, and the proportion of mutants emerging in a mutated progeny was determined. The segregation ratio in X_2 progenies was significantly less than the Mendelian expectation of 0.25, but that in X_3 progenies approached the normal ratio. Analysis of segregation ratios disclosed two kinds of X_1 panicles, those which were thought to be derived from a single cell, and those which seemed to be formed from several cells. Frequency of the first group increased with increasing dose. It is supposed that survival of an initial group of cells until gametogenesis determines the genetic constitution of the progeny. (auth)

30254 THE ROLE OF THE SUPERMOLECULAR STRUCTURE OF DNA IN THE RADIATION INJURY OF CELLS. N. B. Strazhevskaya and V. A. Struchkov (Inst. of Biological Physics, Academy of Sciences, Moscow). Radiobiologiya, 2: 9-16(1962). (In Russian)

It was reported previously that immediately after irradiation of various organisms with a lethal dose, a distinct break is observed in supermolecular structure of DNA (Radiobiologiya 1: 761 (1961)). Identical observations were made with both radiation sensitive tissues, such as the bone marrow of chickens, and with resistant tissues, such as erythrocytes. This problem was further investigated by examining the kinetics of the break of the supermolecular structure of DNA in the thymus and the liver of the rat as a function of the dose and of the time elapsed since the irradiation as these tissues differ greatly in their radiation sensitivity. Identical breaks in the supermolecular structure were observed; the importance of the effect depended on the dose. Shielding the breast region of the animal prevented appearance of the break in the thymus. The initial latent stage was followed by a complete decomposition of the structure in the thymus in the case of irradiation with a lethal dose (500, 1000, and 5000 r). Irradiation at 50 and 200 r resulted in a partial break after 4 hours, remaining at that level for long periods. In the liver, exposure to lethal dose resulted in a reversible break, although it was irreversible at very high dose levels. The radiation sensitivity thus seems to depend on the basic composition of the tissue and on the ability of the tissue to recreate this structure. (TTT)

30255 THE EFFECT OF γ-RADIATION ON THE SYNTHESIS OF DNA IN ISOLATED CELL NUCLEI OF THE THYMUS. II. A COMPARATIVE STUDY OF THE DNA SYNTHESIS IN THE THYMUS NUCLEI AFTER EXPOSURE OF ISOLATED NUCLEI TO γ-RADIATION AND AFTER WHOLE-BODY IRRADIATION OF THE ANIMALS. E. V. Budilova (Inst. of Biological Physics, Academy of Sciences, USSR). Radiobiologiya, 2: 32-5(1962). (In Russian)

It was previously established that the irradiation of the tissue impedes the DNA synthesis; in this connection it was previously shown (Doklady Akad. Nauk SSSR 91: 1183 (1953)) that incorporation of P^{32} into the nucleic acids of the spleen is greatly dependent on the fact whether that organ alone or the whole animal was irradiated. In order to clarify the direct effect of radiation, this problem was further studied by introducing labeled predecessors into the DNA molecule, using tissue nuclei separated from the cytoplasm. The formation of purine and pyrimidine bases was investigated by using C^{14}-formiate and C^{14}-adenine. The first compound is incorporated only in the thymine and the second only in the DNA adenine; this may be used in comparing the effect of ionizing radiations on these reactions. Results indicated that after total irradiation of rats to 1000 r, the ability of the tissue nuclei isolated from the thymus to incorporate either of these compounds is greatly reduced. Irradiation of separate tissue nuclei of the thymus resulted in a slight depression of the incorporation process of the C^{14}-formiate into the DNA thymine while the corresponding adenine process was hardly affected. In general, irradiation in vivo caused more injury than exposure of separate organs to ionizing radiation. (TTT)

30256 BIOCHEMICAL MUTATION INDUCED IN TORULOPSIS UTILIS BY IONIZING RADIATIONS. E. N. Sokurova and T. M. Volkova (Inst. of Microbiology, Academy of Sciences, USSR). Radiobiologiya, 2: 36-42(1962). (In Russian)

The causes of biochemical mutations in microörganisms are of a great interest because the mutants contain injured cells in a well-defined portion of the biosynthesis chain of a given compound. This problem was studied in the yeast cells Torulopsis utilis in aqueous suspension which were exposed to the γ radiation of a 55 r/sec Co^{60} source, determining the appearance of mutants in the original, normal cells and in those formed after irradiation and deficient in biotin. It was found that irradiation increases the frequency of biochemical mutations as compared with spontaneous mutations. The frequency of biochemical mutations increases in direct proportion with the exposure; this linear correlation was more marked in the case of the biotin-depleted strain. No linearity could be established between the dose and the number of cells with a slowed-down growth rate. Some of the slowly growing mutants exhibited injuries to their cytochromes, others to the cell division mechanism. The frequency of the various biochemical mutations was not the same: mutations depleted in biotin and B_1 content occurred most frequently. (TTT)

30257 THE ROLE OF THE HYPOTHALAMUS-HYPOPHYSIS SYSTEM IN THE CREATION OF DISTURBANCES IN THE PERMEABILITY OF THE BLOOD VESSELS OF IRRADIATED ANIMALS. Z. N. Nakhil'nitskaya. Radiobiologiya, 2: 62-8(1962). (In Russian)

Changes in the penetrability of the walls of the blood vessels after exposure to radiation are usually considered as being the direct effect of the radiation. Previous work on the penetrability of the vessels of the ciliary tract (Med. Radiologiya 9: 73(1960)) after irritation with electric current suggested that this factor should be also investigated. Rabbits were irradiated by introducing into the hypophysis small rods of Y^{90} with activities ranging from 12 microcurie to 1.13 millicurie. This localized irradiation caused first an increase of the penetrability of the blood vessel walls within 2 to 3 hours after introducing the isotope into the system, followed by a reduction on the fourth day. It was concluded that the changes of penetrability are due primarily to the direct effect of the irradiation of the walls and are not caused by an action of the hypothalamus–hypophysis region. No correlation could be established between the degree of penetrability and the dose. (TTT)

30258 ACTION OF RADIATION-PROTECTIVE MATERIALS ON THE SORPTION PROPERTIES OF THE TISSUES OF IRRADIATED ANIMALS. A. S. Mochalina and L. L. Khamaide. Radiobiologiya, 2: 121-4(1962). (In Russian)

The correlation of the physico-chemical changes in the cell structure of organisms exposed to ionizing radiation with the functional damage to the cell activity was investigated by examining the dynamics of changes in the sorption characteristics of white mice, using the results for the evaluation of the radioprotective action of certain materials. It was assumed that changes in the sorption properties indicate the depth and the reversibility of the physico-chemical changes in the biosubstratum. The animals were divided in 3 groups: control (unirradiated), exposed to 650 r of Co^{60} γ rays, and irradiated animals protected by β-mercapto ethylamine or cysteine. All the animals were injected with 0.2 ml colloidal solution of Ag^{110} with an activity of 2 μc/g for studying the sorption capacity of the liver, spleen, kidney, small intestine, and muscle tissues. Results showed that the Ag^{110} is preferentially enriched in the liver, spleen, and the kidney; exposure to radiation enhanced this behavior. After introduction of the radioprotective agents into the animals, the sorption of the liver was found to approach that observed under normal conditions. (TTT)

30259 A NEW HYPOTHESIS OF THE BIOLOGICAL EFFECT OF IONIZING RADIATIONS. M. Rossi. Riv. med. aeronaut. e spaziale, 24: 586-620(Oct.-Dec. 1961). (In Italian)

Theories concerning the injurious effects of x and gamma radiations are presented as related to the field of biochemistry: the theory of direct radiant activity on organic molecules and the theory of indirect action on water followed by the release of toxic radicals. A new theory is proposed which stipulates that the primary injurious effect of radiant particles consists of the degradation and abnormal activation of oxidation-reduction enzymes, especially those containing porphyrin. This mechanism is apparent during massive-dose global body irradiation. According to the hypothesis, toxic substances form which are comparable to those induced by the so-called photodynamic phenomenon of photosensitization. Various theoretical considerations are given according to which the radiobiological process can be interpreted as a photodynamic process. Results are also presented of some experimental observations which are favorable to the new hypothesis. (Aerospace Med., 33: 1029-44, Aug. 1962).

30260 EFFECTS OF X-IRRADIATION ON SINGLE CRYSTALS OF MYOGLOBIN. C. C. F. Blake and D. C. Phillips (Royal Institution, London). 16p.

To be published in Proceedings of the IAEA Symposium on The Biological Effects of Ionizing Radiation at the Molecular Level held in Brno, July 1-7, 1962.

The effects of prolonged exposure on single crystals of sperm-whale myoglobin are investigated. The X-ray diffraction pattern obtained changes with irradiation but most of the change obeys a general law to be expected if an increasing proportion of the crystal volume is very seriously disordered as irradiation proceeds while a decreasing proportion is virtually unaltered. Simple corrections can be applied to bring the measurements into good agreement with those from a fresh specimen. The image of the molecule is then very much the same as an undamaged crystal. There are, however, some specific changes in the diffraction pattern in addition to these general changes. These specific effects are small and difficult to measure but it is possible to interpret them in terms of minor structural changes due to relatively mild secondary effects in the otherwise undamaged part of the crystal structure. (auth)

30261 THE INITIAL EFFECTS OF IONIZING RADIATIONS ON CELLS. R. J. C. Harris, ed. A Symposium held in Moscow, October, 1960. London, Academic Press, 1961. 376p. 75s.

A symposium on The Initial Effects of Ionizing Radiations on Cells was held in Moscow, Oct. 1960, supported by UNESCO and the IAEA, and sponsored by the Academy of Sciences of the U.S.S.R. Separate abstracts were prepared for the 24 papers presented. (C.H.)

30262 *THE NATURE OF THE INITIAL RADIATION DAMAGE AT THE SUB-CELLULAR LEVEL.* P. Alexander (Chester Beatty Research Inst., London) and Z. M. Bacq. p.3-19 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

A detailed investigation of the changes produced in DNA, when this is exposed to ionizing radiations under a variety of conditions, indicates that radiochemical damage to DNA is unlikely to be the primary event which initiates the processes which eventually result in the death of irradiated cells. Further support for this view is derived from the fact that the sensitivity of the nucleoprotein when irradiated within the cells is approximately the same for cells of widely different radiosensitivities. Attention to the non-genetic components of the cell is indicated by the observation that treatment with iodoacetate before irradiation can increase the radiosensitivity of cells seven-fold. Studies of mouse leukemia cells in tissue culture indicate that chromosome breakage is not an important anatomical lesion for the death of these cells. The hypothesis that interference with the sub-cellular fine structure of the cell constitutes an important primary lesion is discussed. (auth)

30263 MECHANISMS INVOLVED IN THE INITIATION OF RADIOBIOLOGICAL DAMAGE IN AEROBIC AND ANAEROBIC SYSTEMS. L. H. Gray (Mount Vernon Hospital, Northwood, Middlesex, Eng.). p.21-44 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Loss of reproductive integrity in spores, vegetative bacteria, and cells of higher plants and animals is in general a result of damage to a very small number of macromolecules which are important for proliferation. In dry spores a good deal is now known about the nature and lifetime of intermediates in the chemical reaction chains leading up to the damage to these macromolecules. Water, when present in small amounts, profoundly modifies the reaction chains and shortens the lifetime of many intermediates. In cells of high water content a considerable

fraction of the damage may proceed from the radiolysis of the water. The consequence of a particular kind of macromolecular damage, which has arisen along a particular chemical pathway, may be greatly influenced by nutritional factors, both before and after irradiation. The influence of the chemical and nutritional factors is interrelated. (auth)

30264 ACTION OF RADIATION ON PROTEINS AND NUCLEIC ACIDS IN SOLUTION AND AT INTERPHASES. A. G. Passynsky (Bach Inst. of Biochemistry, Moscow). p.45-57 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Measurement of the oxidation of the SH groups of proteins, the linkages of S^{35}-methionine, the radiation destruction of DNA, and many other methods allow us to establish the presence of molecular changes in thousands of irradiated molecules of proteins even for a dose of 400 to 500 r and in nucleoproteins for 20 to 50 r. However, the application of the statistical theory of the action of radiation shows that the primarily irradiated volumes in the cell only have the dimensions of a few molecules. When establishing the mechanism of biological amplification of the action of radiation it is necessary to take into account the particular significance of damage to the molecules of the biological macromolecules which enter into the composition of the intracellular surfaces of the section (cytoplasmic and nuclear membranes) and also the properties of the living cell as an open system for which the alteration of the transfer constant is of great significance. It has been shown that the appearance of chemical cross-links in monolayers of DNA substantially destroys the structure and increases the area of the monolayer, and radiation damage to the thin surface layers of RNA which separate the enzyme from the substrate (peroxidase-ascorbic acid, H_2O_2) leads to considerable acceleration of their interaction. The variation caused by the damage of only several molecules in the surfaces of the section may be a source of all the subsequent biochemical disruptions and radiation damage to the living cells. (auth)

30265 ELECTRON SPIN RESONANCE (ESR) INVESTIGATIONS ON RADIATION-INDUCED CHEMICAL EFFECTS IN BIOLOGICAL SPECIES. L. A. Blumenfeld and A. E. Kalmanson (Inst. of Chemical Physics, Academy of Science, Moscow). p.59-68 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The ESR method may be used to investigate radiation-produced unpaired electrons in lyophilized biological structures. The authors have studied nearly all the amino acids, a number of di- and tripeptides and various proteins, nucleoproteins and tissues. The number of free radicals produced in γ-irradiated lyophilized proteins is some two or three orders of magnitude less than in amino acids and peptides. It is suggested that conductive channels may exist and that electrons can migrate along these, thus healing the injuries. (auth)

30266 THE ACTION OF X-RAYS ON INTRACELLULAR BACTERIOPHAGE FORMATION. F. Herčík (Biophysical Inst. of Czechoslovak Academy of Sciences, Brno). p.69-74 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Inactivation of the capacity of E. coli B for phage T3 by the action of soft x-rays was measured. The dose-effect curve is biphasic. After small doses, rapid inactivation occurred, but the inactivation was markedly slower after large doses. The capacity of irradiated E. coli B was affected by addition of chloramphenicol. On adding chloramphenicol to irradiated bacteria together with the phage during the logarithmic phase, the decrease in capacity was relatively smaller than might have been expected if the deleterious effects of the two factors were cumulative. In stationary cultures the protective effect of chloramphenicol was less marked. (auth)

30267 THE ACTION OF IONIZING RADIATION ON THE CELLULAR SYNTHESIS OF PROTEIN. Ernest Pollard (Yale Univ., New Haven). p.75-89 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The experiments described are all in accord with the idea that the immediate synthesis of protein is caused by organelles which are sensitive to ionizing radiation in the manner expected for ribosomes in an extended form. The volume of the sensitive regions agrees with the volume of an 80S ribosome and this, independently, substantiates the work of McQuillen, Roberts and Britten (1959) who have shown that the short term incorporation of $^{35}SO_4$ is into 70S ribosomes. The long term effects of radiation are much more difficult to interpret. In separate experiments we have found that there is a reduction in the rate of increase of DNA in irradiated cells. Possibly this means that there is some kind of disruption of the bacterial nucleus which produces an unbalance in the cell and reduces cellular synthetic action later on. Partially successful attempts to express this theoretically have been made but it cannot be claimed that the process is fully understood. (auth)

30268 CHEMICAL SPECIES INDUCED BY X-RAYS IN CELLS AND THEIR ROLE IN RADIATION INJURY. E. L. Powers (Argonne National Lab., Ill.). p.91-106 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The experimental evidence for the existence of several chemical species in the dry bacterial spore after x irradiation is reviewed and examined critically. One very short-lived species is recognized only if oxygen is present during the time of irradiation; another becomes toxic anoxically and is recognized only if hydrogen sulphide is present during irradiation. Certain characteristics of the long-lived free radicals that become toxic to the cell if they combine with oxygen are examined with special attention to reconciliation of biological and chemical evidence with physical evidence gained from ESR techniques. Post-irradiation thermal annealment and post-irradiation treatment with nitric oxide reduce the biological effectiveness of x rays to the same degree; but the former approximately halves ESR signals, whereas the latter removes all signals almost completely. One interpretation of these results is that two general kinds of radicals are formed, one of which is thermally annealable and biologically important the other of which is not. Both react with oxygen and with NO. While the removal of the two kinds of radicals with NO results in obliteration of the ESR signal, the biological result is the same as that seen after thermal annealment because only those radicals are important biologically. Another interpretation is that reaction of one kind of radical with NO results in a harmless complex, whereas reaction with a second kind results in a harmful complex. These studies and others similar to them, especially those involving the role of water in these effects, should lead eventually to some understanding of the early effects of high energy radiations in cells. (auth)

30269 FLUORESCENCE STUDIES OF THE CHANGES UNDERGONE BY NUCLEOPROTEINS AND THEIR DERIVATIVES IN IRRADIATED CELLS. M. N. Meissel, E. M. Brumberg, T. M. Kondratjeva, and I. J. Barsky

(Inst. of Biophysics and Inst. of Radiation and Physicochemical Biology, U.S.S.R. Academy of Sciences, Moscow and Central Scientific Research Inst. of Medical Radiology, Leningrad). p.107-29 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Radiation-induced changes in nucleoproteins, nucleic acids and nucleotides in the cytoplasm and nuclei of living cells are described in the paper. These changes are detected on preparations vitally flurochromed with acridine dyes, by fluorescent microscopy in the visible spectral region, as well as by an investigation of the auto-fluorescence registered in the ultraviolet spectral region. The process described represent labilization and denaturation of DNA-proteins, accumulation of RNA and nucleotides in the cytoplasm, and change in their physicochemical properties which have an effect upon the character of the fluorescence. The intensity and the spectrum of ultraviolet fluorescence of the cells in radiosensitive organs undergo considerable changes soon after x irradiation. Ultraviolet fluorescence microscopy applied to the study of radiation damage to cells yields, especially in combination with ultraviolet absorption microscopy and fluorescence microscopy in the visible spectral region, new facts about the state of cellular nucleoproteins, and their early and later changes due to radiation. (auth)

30270 A DISCUSSION OF SOME IMMEDIATE EFFECTS OF X-IRRADIATION ON LIVING CELLS. Barbara E. Holmes (Cambridge Univ., Eng.). p.131-40 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Attention is drawn to a few of the immediate biochemical effects of x rays mentioned in the literature. Some of these may be due to radical or direct attack on enzyme systems or cell structures. (auth)

30271 RADIATION-INDUCED DISTURBANCES ON THE LIPIDS OF CELLULAR MICROSTRUCTURES. N. N. Doemin and V. D. Blokhina (Pavlov Inst. of Physiology and Inst. of Biophysics, Leningrad). p.141-52 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The content of different lipid fractions has been determined in cellular microstructures of the rabbit liver and intestinal mucosa under normal conditions and after total exposure to 1,000 r γ-rays of cobalt-60. Determinations were made on summary preparations of cytoplasmic organelles and of hyaloplasm of liver cells 24 and 72 hr after exposure and in mitochondria, microsomes and hyaloplasm of intestinal mucosa cells 2, 24, and 72 hr after exposure. Post-irradiation changes were studied in the following lipid fractions: free, extractable by petroleum ether; loosely-bound, extractable by methanol-chloroform mixture (minus the free lipids); and firmly-bound, which can be extracted after alkaline hydrolysis from the residue after methanol-chloroform treatment. Considerable changes in the content of individual lipid fractions and their quantitative interrelation in various micromorphological cellular components may occur within 2 hr of radiation injury. Later on these changes proceeded in various directions. The radiation-induced changes in the content of the various lipid fractions of sub-cellular components of irradiated intestinal mucosa differ from those of liver. The simultaneous changes of the lipid fractions of microsomes, mitochondria, and hyaloplasm may be variously directed. The changes in the composition of lipid complexes of cellular organelles produced by ionizing radiation may be a cause of many subsequent disturbances in the cellular metabolism of damaged tissues. (auth)

30272 THE SIGNIFICANCE OF FREE DEOXYRIBONUCLEOTIDES IN RADIATION DAMAGE. J. Soška, L. Beneš, V. Drášil, Z. Karpfel, E. Paleček, and M. Skalka (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). p.153-63 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

A survey is presented of experiments indicating that a part of the radiation inhibition of DNA synthesis in animals may be caused by some interference of radiation with the synthesis of DNA precursors. Supplementation of bone marrow from irradiated guinea-pigs with nucleotide fractions of chick-embryo extract enhanced the synthesis of DNA. Additions of deoxycytidylic acid to irradiated bone-marrow stimulated the incorporation of P^{32}-phosphate and C^{14}-formate into reticular cells. Administration of some, especially pyrimidine, deoxyribonucleotides into irradiated mice increased the mitotic index in their bone-marrow and tended to restore to normal the increased ratio of DNA purines/pyrimidines. The content of free deoxyribosides increased in rat tissue after irradiation, but the increase of deoxyribonucleotides in rat liver, which takes place after partial hepatectomy, was reduced after irradiation. (auth)

30273 BIOCHEMISTRY AND RADIOBIOLOGY OF CELLULAR NUCLEI. M. Errera (Université Libre, Brussels). p.165-72 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961. (In French)

Results are reported from biochemical studies of radio-induced lesions in cell nuclei. It is pointed out that the phosphorylation and the stability of Na and K ions are particularly sensitive to radiation. Data are included from studies on the incorporation of P^{32} in desoxyribonucleic acid of the thymus and the incorporation of adenine and alanine in protein fractions. Radiation doses of 300 rod had a depressant effect in the three types of metabolism. It is concluded that radiation has a biochemical effect on the entire cell. Mechanisms operating in radiation effects on ribonucleic acid synthesis are discussed. No differences were demonstrated in mechanisms operating in the microsomes and in the nuclei. (C.H.)

30274 ON THE MECHANISM OF LETHAL ACTION OF X-RAYS IN ESCHERICHIA COLI K12. H. Marcovich (Institut Pasteur, Paris). p.173-82 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Crosses were utilized in order to elucidate the mechanism of the lethal effect of x rays on Escherichia coli K12. These bacteria possess two to three nuclear bodies and are killed according to a one-hit dose—effect relationship. The experiments were designed to search for the existence of x ray–dominated lethal mutations in one of the nuclei, transferable to the recombinants. No such mutation was detected. (auth)

30275 DAMAGE TO THE REPRODUCTIVE CAPACITY OF HUMAN CELLS IN TISSUE CULTURE BY IONIZING RADIATIONS OF DIFFERENT LINEAR ENERGY TRANSFER. G. W. Barendsen (Radiobiological Inst., Organization for Health Research TNO, Rijswijk, Netherlands). p.183-94 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Kidney cells of human origin, cultured by the technique developed by Puck et al., (1956) were irradiated with α, β, 200 Kv x and 20 Kv x radiation. The cells were cultured in special dishes with a Melinex bottom 6μ thick, which permitted irradiation from outside with alpha particles from Po^{210} and beta particles from Y^{90}. The number of cells, which after irradiation had retained the capacity

for clone formation, was counted. The survival curve was found to be exponential in the case of α-irradiation, whereas with other radiations a more complicated curve was obtained, which cannot be interpreted by a two hit mechanism. The RBE of α-radiation was found to range from 2.5 at high doses to 6.0 at low doses. From the experiments with α-radiation the sensitive area of these cells for the inhibition of clone formation was calculated to be $40\mu^2$, which was found to be approximately equal to the cross-sectional area of the nuclei. It may be inferred that clone formation is inhibited if one α-particle passes somewhere through the nucleus. Experiments with fractionated doses showed that partial repair takes place after x and β irradiation, but no recovery could be detected after α-irradiation. Furthermore cells were irradiated with various doses of α-radiation followed by x irradiation and conversely. In these experiments no departure from additivity was observed i.e., x radiation acts on cells surviving after α-irradiation as if they were not irradiated at all. This contrasts with the effect of a second dose of x radiation, which depends on the amount of x radiation the cells have received before i.e., in this case there is some cumulative effect. Experiments are discussed on the sensitivity of these cells to α and x radiation when in equilibrium with different mixtures of nitrogen and oxygen. The absence of oxygen protects the cells in x irradiation experiments but a very small decrease in sensitivity is found with α-radiation. (auth)

30276 PHOSPHATE METABOLISM IN THE NUCLEUS. L. A. Stocken (Oxford Univ., Eng.). p.195-9 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

A brief account is given of the effects of x radiation on the biochemical events in the mitotic cycle leading to the formation of nucleic acids. It is suggested that low doses produce a disorganization of binding sites in the nucleus. Preliminary data on the capacity of the nucleus to bind inorganic and organo-phosphates are provided. (auth)

30277 INITIAL STEPS IN RADIATION DAMAGE TO CHROMOSOMES AND MEANS OF PREVENTING THIS EFFECT. Alexander Hollaender (Oak Ridge National Lab., Tenn.). p.201-9 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

Two approaches to the analysis of the initial steps in radiation damage are discussed. The first is the use of very low radiation levels. Thus the entire effect of small doses of radiation on the grasshopper neuroblast can be reversed by immediate treatment with hypertonic salt solution. X-ray-induced chromosomal aberrations in Tradescantia pollen may be modified by pre- and post-treatment with ultraviolet radiation. The second approach is the investigation of protection against radiation damage. The killing of A. terreus cells and mutation are not interdependent. Pre-mutation damage in Paramecium can be repaired. All these studies establish that it is possible to manipulate living cells in regard to survival, mitósis, chromosome breaks and mutation production by radiation. (auth)

30278 ON THE MECHANISM OF INHIBITION OF CELL DIVISION INDUCED BY IONIZING RADIATION. A. V. Lebedinsky, V. M. Mastryukova, and A. D. Strzhizhovsky (Academy of Medical Sciences, Moscow). p.211-22 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The inhibition of mitotic activity lies at the very basis of the radiation effect on physiological regeneration. The inhibition of this activity may result from radiation damage to the synthesis of the products that are necessary for cell division or from damage to the mitotic apparatus with the blocking of mitosis even in the case where there is a sufficient quantity of the products necessary for cell division. The biochemical disturbances are reversible, the genetic disturbances are irreversible. The cells with the damaged genetic apparatus give rise to pathological mitoses and perish during the first generation. On the basis of these assumptions a formula was elaborated for determining the index of normal mitosis as the function of time and irradiation dose. Besides the intracellular processes mentioned the mitotic activity of cells in an organism is influenced also by extracellular processes. Experimental data are presented concerning the influence of nervous, hormonal and cytolytic factors on mitotic activity in irradiated organisms. The necessity to modify the equation is suggested so that both intracellular and extracellular factors may be taken into account. (auth)

30279 THE BIOCHEMICAL MECHANISM OF THE DISTURBANCE OF CELL DIVISION BY RADIATION. A. M. Kuzin (Inst. of Biophysics, Academy of Sciences, Moscow). p.223-35 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

X irradiation of fully grown leaves of Vicia faba, causes almost immediate activation of oxidative enzymes of the polyphenoloxidase and peroxidase type. The products of oxidation of tyrosine (or similar substances) increase. These block DNA synthesis and thus prevent cells entering mitosis. The appearance of antimitotics was demonstrated both by post-irradiation observation of the remote inhibition of mitosis in the points of growth (which were screened during the irradiation) and also by extraction of the antimitotics from the irradiated leaves, their purification and testing on un-irradiated roots of Vicia faba. It was shown by model experiments, that low molecular weight products of the enzymatic oxidation of tyrosine possess antimitotic activity, i.e., the capacity to combine with highly-polymerized DNA and to protect DNA in vitro against radiation-induced depolymerization. (auth)

30280 THE ROLE OF CELLULAR DAMAGE IN THE MAMMALIAN RADIATION SYNDROME. E. Y. Grayevsky, I. M. Shapiro, M. M. Konstantinova, and N. F. Barakina (Severtzov Inst. of Animal Morphology, Moscow). p.237-55 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The mass destruction of the cells of hematopoietic organs and of the intestine is one of the most important causes of death in an irradiated animal. The death of these cells is only observed in directly irradiated tissues not connected with mitosis and is the result of the activity of the damaged intracellular substrate. The destruction is not a direct consequence of the variation of the content of nucleic acids in the nuclei. The regeneration of the irradiated tissues occurs from potentially viable cells and is limited first of all by the number of cells having lethal chromosome injuries and also by the reduced mitotic activity. Prophylactic defensive agents exert their action at the cellular level. Most agents protect by producing hypoxia in the radiosensitive tissues. Some sulphur-containing protective agents do not reduce the content of oxygen in the tissues. (auth)

30281 STUDIES ON ENZYMES AND YEAST CELLS WITH ACCELERATED HEAVY IONS. Cornelius A. Tobias, Tor Brustad, and Thomas Manney (Univ. of California, Berkeley). p.257-67 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The action of heavy accelerated ions, with short-range

but very high linear energy transfer, on enzyme molecules, such as trypsin, in the dry state can be modified by the presence of the protective substances, dextran, lactose, and ribose. The inactivation cross-sections obtained are discussed in the light of current theories. Heavy ions produce mutations in irradiated yeast cells and inhibition of cell division and colony formation. The effects produced depend upon the post-irradiation physical environment and the physiological state of the cells. (auth)

30282 THE RHYTHM OF OXIDATIVE PROCESSES AND ITS DISTURBANCE UNDER THE ACTION OF RADIATION. G. M. Frank and A. D. Snezhko (Inst. of Biophysics, Academy of Sciences, Moscow). p.269-85 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

A modified polarographic method was developed in which open platinum needles are used as electrodes, for following the relative changes in free oxygen content of tissues at the expense of the component determined by diffusion current, which was determined by the concentration of free oxygen. Distinct rhythmical changes in free oxygen content and the response to disturbances of this rhythmical activity by irradiation were demonstrated in a number of biological systems, including the rootlets of Vicia faba seedlings, cultures of yeast cells, and an isolated cricket nerve ganglion. Results are reported in detail from studies on tissue respiration in rabbit brains following whole-body exposure to doses of 1,000 r, local irradiation to the head of doses from 1,000 to 3,000 r, exposure of the abdomen with the head shielded, and exposure of a very small area of the brain through an aperture in a lead screen that shielded the entire body. The character of the rhythmical activity is described, and it was concluded that several components contribute to this activity. During the first few hours after irradiation no impoverishment of pure oxygen in the brain tissue was found, despite profound disturbances of the hemodynamics. Reactions ascribed to a deterioration of the ability of the tissue to utilize oxygen were noted 2 to 3 hr after whole-body exposure to 1,000 r or local head irradiation of 1,000 to 3,000 r. Shielding of the head and irradiation of the abdomen led to a reverse picture of oxygen utilization. This was interpreted as an indication of the direct local response of brain tissue and to a deficiency of free oxygen as the basis of hemodynamic disturbances. The rhythmical free oxygen level was also shown to be functionally related to the state of the central nervous system. Applications of the method in investigations of radiobiological reactions in living cells are discussed. (C.H.)

30283 IMMEDIATE REACTIONS OF NERVES AND MUSCLES TO IONIZING RADIATION. O. Hug and H. J. Schliep (Universität Munich and Inst. für Strahlenschutzforschung der Gesellschaft für Kernforschung, Neuherberg, Ger.). p.287-300 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

In contrast to the peripheral motoric nerves and striated muscles, but similar to smooth muscle organs of vertebrates, nerve-muscle preparations of worms show immediate partially reversible reactions to relatively low doses of x rays as changes in motility and contraction. Nerve-muscle preparations are more sensitive than isolated muscles. Remarkable is the strong dose-rate dependence of these functional changes. There are some indications that the effects are due to reversible changes of cell permeability under and shortly after irradiation. (auth)

30284 MECHANISMS OF CHEMICAL RADIATION PROTECTION. Z. M. Bacq (Université Liège and Laboratoire de Recherches pour la Protection des Populations Civiles, Liège) and P. Alexander. P.301-14 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The mechanisms by which added chemical substances in particular cysteamine, alter the chemical changes produced by ionizing radiations are discussed. Examples are given of protection of proteins and nucleic acids by radical scavenging, energy transfer and repair. In mammals the protection given by –SH compounds is not due to the production of anoxia and is believed to be brought about by one or more of the chemical mechanisms working at the level of the primary lesion. Protection of mammals by histamine is due to the production of anoxia by pharmacological means because localized protection confined to the site of injection is not seen. When considering the mechanisms of protection every tissue or organ must be studied separately as several mechanisms may be active simultaneously or synergistically. (auth)

30285 KINETICS OF PRIMARY REACTIONS AND CHEMICAL PROTECTION. V. N. Tarusov (Moscow State Univ.). p.315-25 of "The Initial Effects of Ionizing Radiations on Cells." London, Academic Press, 1961.

The kinetics of the protective reaction of anti-oxidizing agents was studied in order to analyse the mechanisms of the primary reactions. New facts have been adduced which testify to the chain mechanism of radiochemical oxidizing reactions induced by radiation. It has been established that chemical protection is afforded not only when the oxygen level is reduced but also when the pressure is raised above a certain critical level which is the characteristic property of oxidizing reactions of the chain type, with branched chains. It has been established that the kinetics of the variation of the amount of lipoperoxides in the tissues of irradiated organisms corresponds to the formula for the accumulation of intermediate products of branched chain reactions. But the kinetics for the variation in unsaturated fatty acids is analogous to the kinetics for the accumulation of the final products in branched chain reactions. The presence of chain oxidizing reactions is confirmed by the discovery of very weak luminescence in the region of 4,000 Å to 5,200 Å which increases considerably under irradiation conditions. The quantitative analysis of the data concerning the protective action of increased oxygen and of anti-oxidants has shown that these factors are inhibitors of oxidative chain reactions in cell lipids. It has also been shown that the action of anti-oxidants is restricted and in the most favorable conditions they cannot absorb more than 50% of the dose. This incomplete protection shows that the oxidation chain reactions are not the sole primary reactions and apart from them there arise, and are developed, non-oxidative reactions in various biological substrata. Investigations have shown that this is mainly a reaction of an autolytic character which develops after irradiation. The protective substances which contain –SH groups activate this type of reaction. The investigations were carried out in yeast of haploid and diploid strains, in mice and in rats. (auth)

Radiation Sickness

30286 (JPRS-15154) THE TRANSPLANTATION OF BONE MARROW DURING ACUTE RADIATION SICKNESS UNDER EXPERIMENTAL CONDITIONS. G. E. (Ye.) Kevlishvili. Translation of p.3-52 from "Transplantatsiya Kostnogo Mozga Pri Ostroy Luchevoy Bolezni v Eksperimente" (a publication of publishing House of the Academy of Sciences Georgian, SSR, Tbilisi, 1961). 46p.

The effects of intravenous bone marrow transplantations against acute radiation sickness in dogs were studied. Acute radiation sickness in dogs irradiated with lethal doses (600 r) proceeded in a less severe state both clinically and hematologically following intravenous injection of bone marrow suspensions. The transplantation of puppy bone marrow proved to be much more effective than bone marrow from adult dogs. The best therapeutic effect was observed with intraosseal transplantation of puppy bone marrow suspension concurrently with the administration of dimedrol (2 ml of 2% solution intramuscularly daily for a period of 10 to 12 days). Transplantation yields the best effect if carried out on the third or fourth day after irradiation. Repeated transplantations of bone marrow (more than 2) cause a depression of hemopoiesis and death of the animals. The data confirm the effectiveness of bone marrow transplantation. (P.C.H.)

30287 HEMATOLOGICAL CHANGES IN IRRADIATION DISEASE. III. RETICULOCYTE CHANGES AFTER EXOGENOUS WHOLE-BODY IRRADIATION AND AFTER INCORPORATION OF SOME RADIOISOTOPES IN RATS. Z. Dienstbier, V. Slouka, A. Šmíd, and F. Vítek (Charles Univ., Prague). Atompraxis, 8: 295-7(Aug. 1962). (In English)

Attention is drawn to the reticulocytosis which was observed after the incorporation of various radioisotopes, in contradistinction to constant early reticulocytopenia after exogenous irradiation. (auth)

30288 THE CONTROL OF THE NATURAL MUTATION RATE BY MEANS OF CYSTEINE AND STREPTOMYCIN. N. P. Dubinin and V. K. Shcherbakov (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk, S.S.S.R., 145: 427-9(July 11, 1962). (In Russian)

Seeds of the Russian broad bean (Vicia faba) were found to have a high natural mutation rate. The number of abnormal chromosomal rearrangements was 20.3 ± 0.9% in cells of the bean rootlets. The seeds sprout in 48 hours after being steeped in water at 25°C. The first mitosis can be studied cytologically by fixation of the sprout (12 to 17 mm in length). On treating the sprout with a solution containing 1.3×10^{-3} M cysteine during the period of 72 to 96 hours after steeping, it was found that the natural mutagenic rate had decreased from 20.3% to 12.2%. Concentrations of streptomycin sulfate of 0.01 to 50 γ/ml decreased the natural mutagenic rate from 11 to 13.5% observed chromosomal rearrangements. A low concentration of 0.001 γ/ml, and a high concentration of 100 γ/ml showed no antimutagenic effect. A natural mutagenic rate of 20.3% rearrangements was observed in these experiments. A concentration of 0.001 γ/ml streptomycin showed a protective mutagenic effect in onion rootlets, but no effect at all in the bean rootlets. High concentrations of streptomycin caused an increase in mutation in onion rootlets, but did not have any effect on the natural mutagenic rate in bean rootlets. (TTT)

30289 THE EFFECT OF THE DURATION OF MODERATE HYPOTHERMY ON THE OXYGEN TENSION IN TISSUE AND ON THE RADIOSENSITIVITY OF MICE. M. M. Konstantinova (A. N. Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk, S.S.S.R., 145: 436-7(July 11, 1962). (In Russian)

A decrease in the body temperature of warm-blooded animals at the moment of irradiation leads to a considerable decrease in the sensitivity of the animal to the effects of ionizing radiation. The effect of a short (30 minutes) and a more protracted (2 hours) moderate hypothermy (rectal temperature of 18°C) on the radioresistance of mice and on the oxygen tension in the spleen and liver were investigated experimentally. The chilled mice were given an absolutely lethal dose of 900 r of Co^{60} γ rays. There were no survivors among the irradiated control mice. The survival rate at 30 days was 15% for the mice chilled for 30 minutes, and 7.0% for the mice chilled for 2 hours before irradiation. The average life span was 9.0 days for 30 minutes chilling, and 9.5 days for a 2 hour chilling period. It was found that the oxygen tension in the liver and spleen decreased by 45% from its initial level in both series of mice. Thus, increasing the chilling period from 30 minutes to 2 hours does not lead to a further decrease of oxygen tension in the tissues, and does not increase the radioresistance of the mice. (TTT)

30290 THE DIPHOSPHOPYRIDINNUCLEOTIDE EFFECT DURING THE RESPIRATION OF HOMOGENIZED LIVER OF RATS EXPOSED TO γ-RADIATION. V. A. Kopylov and A. M. Kuzin (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 145: 438-9(July 11, 1962). (In Russian)

Rats 130 to 150 grams in weight were given a total x-ray dose of 1000 r. The rats were killed by decapitation, the blood was removed, and the liver was cut out immediately after irradiation. One gram samples of liver were homogenized 2 to 3 minutes at 4°C in a phosphate-citrate buffer in a volume of 10 ml at a pH of 7.3. The rate of absorption of oxygen, as measured in a Warburg unit on a 2 ml sample for a period of 30 minutes, turned out to be the same for the experimental and control samples. It appeared that quinones formed during irradiation had no effect on the respiratory rate. However, on adding 1.6×10^{-5} moles of diphosphopyridinnucleotide (DPN) to 2 ml of sample, the respiratory rate increased sharply (70 to 100%) for samples of homogenized liver from the irradiated rats, and remained almost unchanged for the control samples. Compounds of a quinoid character, formed during irradiation, lead to a sharp increase in oxygen absorption in the presence of DPN, and to a suppression of oxidative phosphorylation. (TTT)

30291 BIOCHEMICAL CHANGES IN THE SPERMATOZOA AND BLOOD OF RABBITS SUBJECTED TO IRRADIATION WITH X-RAYS (AS RELATED TO THE NUMERICAL PREDOMINANCE OF MALES IN THE PROGENY). V. N. Shreder (A. N. Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 145: 926-8(Aug. 1962). (In Russian)

Ten male rabbits were given a whole-body x-ray dose of 250 r. Another series of ten male rabbits was given a local dose of 75 r to the testicles. The irradiated males were mated with unirradiated females. The number of male progeny was found to be 81% for the rabbits with a whole-body radiation of 250 r, and 73% for the rabbits given a local dose of 75 r. The controls had 48% males among the progeny. The activity of the alkaline phosphatase, the contents of DNA and RNA, and the oxidative activity (the time required for oxidation of the leucobase thioneine by the blood serum) were determined in the blood serum of the rabbits. The cytochromoxidase activity in the spermatozoa was determined by noting the amount of oxygen absorbed by 100 mg of spermatozoa in one hour. The results show that there is a sharp increase in activity of alkali phosphatase in the sperm and a sharp decrease in the activity of this ferment in the blood plasma of irradiated rabbits. At the same time the content of DNA decreased in the sperm and increased in the blood serum. The content of RNA was higher in the sperm, but hardly changed in the blood serum. With local irradiations the changes in the sperm and blood serum were almost identical. Changes in respiration and

nucleic acid exchange could be detected along with the increase in male progeny. (TTT)

30292 OPERATIONS ON THE BLOOD VESSELS AND NERVES IN ACUTE RADIATION SICKNESS. L. A. Melnik (Chernovitskii Inst. of Medicine, USSR). Med. Radiol., 7: No. 8, 47-52(Aug. 1962). (In Russian)

Operations were carried out in dogs at different periods of acute radiation sickness. In acute radiation sickness and in its treatment the ligation as well as lateral and circular ligatures of arteries, veins, nerves, and plastic repair of arterial defects are quite feasible. Best results of the lateral and circular ligatures were obtained in the initial stage of radiation sickness and during convalescence. In more than half the cases, complications (thrombogenesis hemorrhage and suppuration of wounds) were encountered at the peak of the disease. (auth)

30293 THE EFFECT OF BONE MARROW IMPLANTATION ON THE DEVELOPMENT OF RADIATION SICKNESS INDUCED BY X-RAYS IN GRAVID ANIMALS AND THEIR PROGENY. E. Ya. Ivanova, E. A. Parshina, and E. I. Aleksandrovich (Inst. of Genecology, Academy of Medical Sciences, USSR and Leningrad Inst. of Pediatrics). Med. Radiol., 7: No. 8, 52-9(Aug. 1962). (In Russian)

Intravenous administration of bone marrow to gravid rabbits subjected to a single whole-body x-ray dose lethal for fetuses (700 r) improved the course of radiation sickness in rabbits and in some of them preserved the progeny. However, in newborn rabbits there were signs of radiation injury and developmental abnormalities in most cases. In newborn rabbits of animals subjected to a lower dose of (400 r), which underwent bone marrow implantation on the 3rd day following the irradiation, the blood picture was within normal values, while in control rabbits marked signs of radiation sickness appeared. The degree of differentiation of the bone system in rabbits of the experimental group was higher than in those of the control group. (auth)

30294 THE EFFECT OF THE WHOLE-BODY X-RADIATION ON THE CHOLESTEROL CONTENT IN THE BLOOD SERUM OF RABBITS AND DOGS. E. K. Shkhinek (Leningrad Inst. of Experimental Medicine). Radiobiologiya, 2: 17-21(1962). (In Russian)

Disturbance of the fat–lipoid metabolism plays an important role in the pathogenesis of radiation sickness. This problem was studied by determining the cholesterol content of the blood serum of rabbits and dogs exposed to whole-body radiation, attempting to clarify simultaneously also the effect of β-cystosterol which was found to reduce the cholesterol content of blood. The method of S. M. Neuschlosz (Biochem. Z. 225: 123(1930)) was used for the analytical measurements. Results showed a sudden increase of the cholesterol count of the blood serum of the rabbit 24 hours after irradiation; the concentration decreased again to a normal value in the animals which recovered. Dogs did not show such an increase during the first days. In both types of animals which died of radiation sickness the cholesterol content continued to increase considerably until death. The β-cytosterol did not affect the dynamics of the cholesterol reaction and did not exert a protective effect. (TTT)

30295 SOME ASPECTS OF THE ACETYL CHOLINE METABOLISM SHORTLY AFTER EXPOSURE TO A SUBLETHAL DOSE OF γ-RAYS. N. N. Demin and N. V. Korneeva. Radiobiologiya, 2: 22-4(1962). (In Russian)

Following up previous findings (Radiobiologiya 1: 761 (1961)) that exposure of rats to γ rays at a dose of 800 r affects the animals' acetyl choline metabolism, similar exposure tests were carried out at sublethal doses. After exposing the white rats weighing 180 to 200 g to a dose of 100 r from a Co^{60} source, groups of them were killed at the end periods ranging from 10 minutes to 24 hours. Comparison of the acetyl choline content in the brain, liver, and the small intestine of the test and the control animals, it was found that the short, 13-sec exposure to the 460 r/min source caused noticeable changes even after 10 minutes in the free and bound acetyl choline concentration, the activity of the acetyl choline esterase and of the nonspecific choline esterase in the tested tissues. These changes are probably due to compensating reactions of the organism. (TTT)

30296 THE EFFECT OF THE X-RADIATION ON THE CHOLESTEROL METABOLISM OF DOGS. L. S. Sulaeva (Scientific Research Inst. of Oncology and Radiobiology, Alma-Ata, USSR). Radiobiologiya, 2: 25-31(1962). (In Russian)

There are contradictory data concerning the effect of ionizing radiations on the lipid and on the cholesterol metabolism. This problem was investigated by means of irradiation tests with x rays of dogs. Male animals were exposed to a single dose of about 500 r; subsequent analysis indicated that the exposure generated variable changes in the total cholesterol content and in the concentration of its esters in the serum of the arterial blood. About three days after the irradiation the concentration increased; this was followed by a decrease after 7 to 14 days and a second increase after 21 days. A similar observation was made in the corresponding contents of the gall bladder. The hypercholesterolemia is due largely to the increased output of cholesterol and its esters. During the development of the radiation sickness the esterification process of the cholesterol in the liver is disturbed; this is manifested by the gradual decrease of the coefficient of esterification in the blood, especially on the seventh day after the exposure, at which time similar effects could be observed in the brain and after 21 days in the brain. (TTT)

30297 STUDY OF THE EFFECT OF X-RADIATION ON THE MEDULLAR LAYER OF THE ADRENAL GLANDS AND ITS HORMONES. B. M. Graevskaya and R. N. Shchedrina (Inst. of Genetics, Moscow). Radiobiologiya, 2: 54-61(1962). (In Russian)

Exposure of the adrenal glands to ionizing radiation results in marked changes which affect the course of radiation sickness. This problem was further studied by determining the changes in the concentration of adrenalin and similar materials in the adrenal glands, the blood, and the liver of white mice, aged between 8 to 10 weeks, exposed to x ray doses of 600 and 2000 r at the dose rate of 30 to 35 r/min. The animals were killed at various periods, ranging from 2 hours to 8 days after the irradiation. In another test series the adrenal glands of the animals were shielded with 3-mm thick lead foils. It was found that the radiation caused considerable changes in the relative amounts of the catecholamines in the organs; it is assumed that the changes were caused by both the direct irradiation of the glands and to remote effects of other parts of the irradiated animals. The radiation also induced a reduction of the free adrenalin content of the adrenal gland; this was probably caused by increase of the secretion from the gland, reversal of the adrenalin into dehydroadrenalin, and inhibition of the adrenalin synthesis. (TTT)

30298 STUDY OF THE EFFECT OF IONIZING RADIATIONS ON A MODEL OF REFLEX EPILEPSY. A. F. Semiokhina (Moscow State Univ. and Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 69-74(1962). (In Russian)

A model of reflex epilepsy of rats was investigated by examining the effect of relatively low doses of x radiation on the excitation and inhibition processes occurring during convulsive epileptic attacks due to irritation by sound waves. White rats, selected for their excitability, were exposed to sound waves for periods of 1½ minutes; in case of convulsive seizure of the animal, the sound was stopped earlier. It was found that the radiation dose of 250 r, given locally or to the whole body, weakens the inhibiting effect, changing the motion reaction of the animals as a response to excitation by the sound waves. Br introduced prior to the irradiation exerts some prophylactic effect, preventing this weakening action. The irradiation facilitates an earlier appearance of myoclonic attacks which are considered a symptom of the chronic weakening of the inhibiting action. (TTT)

30299 ANALYSIS OF THE INFLUENCE OF THE HYPOTHALAMUS ON THE DYNAMICS OF THE SPINAL REFLEXES AFTER LOCAL IRRADIATIONS. II. LOCAL IRRADIATION OF THE SPINAL CORD AND THE SHIN OF RABBITS. Z. M. Gvozdikova. Radiobiologiya, 2: 75-81 (1962). (In Russian)

Local irradiation tests were carried out on the spinal cord and the shin of rabbits for the purpose of obtaining more information on the direct and reflex action of radiation on the hypothalamic region. Of the 25 animals, 5 were used for control and each of the 2 groups of 10 animals was used for irradiating either the spinal cord or the shin. The hypothalamus was excited by means of electrodes. The amplitude of the current of the flexor action, their frequency, and the latent period of the bending reflex were determined. Hard x rays were directed on the lumbar vertebrae and soft radiation was applied on the lower third portion of the leg, using a dose of 1000 r. It was found that in the case a strong depression of the spinal centers, irritation of the hypothalamus stimulates the reflex activity. Increase of the excitability of the subtubercular region seemed to be one of the reasons of the depression of spinal reflexes. Change of the state of hypothalamus, noticed after irradiation of the shin of the animals, points toward the reflex-type nature of this disturbance. (TTT)

30300 REGULATION OF THE CEREBRAL BLOOD CIRCULATION IN IRRADIATED ANIMALS. R. M. Lyubimova-Gerasimova, Radiobiologiya, 2: 82-6(1962). (In Russian)

The reflex action on the blood vessels of the brain was studied while the animal was exposed to a dose of 1000 r of ionizing radiation, using the flow rate of the blood as the indicator. This value was obtained by means of a thermoelectrode fastened in the opening of the right parietal bone of the skull of the animal. The results indicated a considerable change in the circulatory system of the cerebral blood of the animals exposed to the radiation. The regulation becomes insufficient in view of inhibition of the compensatory mechanisms, resulting in an increased tendency toward spasms. The vascular system is changed and the mechanisms controlling the internal medium are disturbed. (TTT)

30301 THE RADIOSENSITIVITY OF THE SPERMATOZOA OF THE LOACH (MISGURNUS FOSSILIS L). E. D. Bakulina, G. L. Pokrovskaya, and D. D. Romashov (Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 92-100 (1962). (In Russian)

The radiosensitivity of the male sexual cells of the loach was chosen for closer study as it was previously investigated by A. A. Neĭfakh (Doklady Akad. Nauk SSSR, 111: 585 (1956)). The spermatozoa were irradiated with doses ranging from 100 r to 1000 kr, using the viability of the embryos resulting from the impregnation of normal roes with irradiated sperms as the indicator. The mature sperm cells were obtained within 36 to 40 hours after injection with a chorionic hormone. Results showed that the spermatozoa retained their ability to impregnate throughout the investigated range: up to 200 kr there was not noticeable reduction of this capacity and even at 1000 kr up to 1% of the sperms were viable. The nucleus was the most radiosensitive part of the system; even the lowest dose used created a perceptible increase of chromosome breaks, reducing somewhat the viability. Doses between 2 to 5 kr appeared to be the most dangerous; although added exposure led ultimately to the complete deactivation of the cells, the hazard to the offspring was decreased. A parallelism was noted between the percentage of mitoses with bridged anaphase and telephase and the percentage of the destroyed offspring. (TTT)

30302 EARLY ULTRASTRUCTURAL CHANGES OF THE MITOCHONDRIA OF THE LYMPHOCITES OF IRRADIATED ANIMALS. V. M. Manteĭfel' and M. N. Meisel' (Inst. of Radiation, Biology, and Chemical Physics, Moscow). Radiobiologiya, 2: 101-4(1962). (In Russian)

One of the first symptoms of radiation injury is a disturbance of the oxidative phosphorolysis, connected primarily with the enzymatic activity of cytoplasmic mitochondria, and to a lesser degree with the metabolic functions of the nucleus. Electron microscopic investigation was used for examining changes in the fine structure of the lymphocites in the lymphatic nodes of irradiated animals within 2 hours after the irradiation before the appearance of destructive phenomena. White rats were exposed to a dose of 500 r at a dose rate of 51.8 r/min, taking samples from the groins of the animals at periods of ½, 1, and 2 hours after the exposure. Examination showed damage to the ultrastructure of the mitochondria within ½ hour; the damaged areas were in close contact with the cell nucleus. The observed early damage might be responsible for disturbing the oxidative phosphorolysis. (TTT)

30303 PERIODICITY OF CYTOCHEMICAL CHANGES OF RIBONUCLEOPROTEIDS IN THE CELLS OF THE CENTRAL NERVOUS SYSTEM DURING THE LATENT PERIOD AND AT THE TIME OF THE APPEARANCE OF THE EARLY RADIATION SYNDROME. A. L. Shabadash, N. D. Agracheva, and T. I. Zelikina (Inst. of Biological Physics, Moscow). Radiobiologiya, 2: 105-14(1962). (In Russian)

Determination of changes in the electrocolloidal properties of ribonucleoproteids (RNP) of the cell, indicated by the shift of the isoelectric point, is very useful for examining the reactivity changes of the organoids and may also serve to detect radiation injury. It was shown previously (Doklady Akad. Nauk SSSR, 128: 1290 (1950); ibid. 136: 222 (1961)) that the shift of the isoelectric point changes with time. This was further investigated by subjecting male white rats to a single γ dose of 1000 r at a dose rate of 100 r/min., determining subsequently the isoelectric point, the RNP content of the mitochondria, and of the tigroid at periods ranging up to 8 days after the exposure. It was found that from the first minutes on after the irradiation significant cytochemical changes take place in the most important cell organoids. The reaction of the RNP to radiation consists in a shift of the isoelectric point toward the alakaline side, followed by a reversal; these alternating reactions continue for 8 days. Five periods of cytochemical transformations of the RNP could be distinguished in the mitochondria and the tigroid of the central nervous

system during the first 7 days; the theory of a latent period of the radiation sickness must be revised in view of the evidence of continuous successive changes in the neurons. (TTT)

30304 GANGLIA OF THE PERIPHERAL NERVOUS SYSTEM OF GUINEA PIGS EXPOSED TO X-RADIATION. O. A. Danilova (Sechenov Inst. of Evolution Physiology, Leningrad). Radiobiologiya, 2: 115-20(1962). (In Russian)

In order to determine the biochemical changes accompanying radiation injuries, histochemical studies were carried out on the neurons in the sensory and vegetative ganglia of the peripheral nervous system of guinea pigs exposed to 200 or 600 r of x radiation. The animals were killed at periods ranging from 1 day to 1 year after the exposure. Increase of the dose was found to affect the depth of chromatolysis; at lower exposures the chromatolysis was not as deep and remained at the same level for extended periods. The DNA content of the neurons of the vegetative ganglia was found to increase first and then to decrease after exposing the animal to 200 r; exposure to 600 r resulted in the shortening or the elimination of the first period of increase. No clear correlation could be found in the spinal ganglia between variation of the dose and the DNA content. The higher dose on the other hand caused deeper and longer-lasting hydropic injuries. (TTT)

30305 THE OXYGEN EFFECT IN THE CASE OF WHOLE-BODY EXPOSURE TO HIGH-ENERGY PROTONS. S. P. Yaromonenko, G. A. Avrunina, V. S. Shashkov, and R. D. Govorun (Inst. of Industrial Hygiene and Occupational Diseases, Moscow). Radiobiologiya, 2: 125-7(1962). (In Russian)

Most studies on radiation protection were carried out with γ rays which possess high penetrating power and low ionization density; therefore the protection of mice against the effects of whole-body irradiation with 660-Mev protons was investigated. The beam from the synchrocyclotron of the Joint Institute of Nuclear Investigation had an average flux density of 10^8 to 10^9 protons/cm^3 sec and a dose rate of 3 to 400 rad/min; the pulses lasted 2 to 400 microseconds at a frequency of about 100/sec. Radioprotective materials, such as β-mercaptoethylamine hydrochloride, cysteine dihydrochloride, S, β-aminoethylisothiuronium bromide hydrobromide, 5-oxytryptamine, creatinine sulfate (serotinine), and 5-methoxytryptamine hydrochloride were introduced into the white mice 10 to 15 minutes prior to the irradiation in doses of 1 to 3 mg. Results indicated that all the preparations tried exerted a protective action, as evidenced by the increase of the survival rate and the increase of the average life span of the animals. This action was due to the reduction of the ionization density of the beam and provided an indirect proof concerning the validity of the oxygen effect in biological protection. This effect, described by P. Bonet-Maury (Disc. Faraday Soc., 12: 72(1952)), involves the increase of the H_2O_2 yield as a function of particle yield in the irradiation of water. (TTT)

30306 INFLUENCE OF VARIOUS DEXTRAN PREPARATIONS ON THE SURVIVAL OF MICE IN CASE OF THE ACUTE RADIATION SICKNESS. A. A. Bagdasarov, I. L. Chertkov, and T. V. Polushina (Central Inst. of Hematology and Blood Transfusion, Moscow). Radiobiologiya, 2: 128-33(1962). (In Russian)

The results of studies on the protective action of high-molecular weight compounds against the effects of radiation sickness are contradictory. The problem was further investigated by introducing dextran and dextran preparations with various molecular weights into white mice which were subsequently exposed to a dose of 700 r of x radiation. The action of the materials was evaluated on the basis of the survival rate of the irradiated animals; tests were also carried out on the effect on transplanted tumors. The results indicated that a partially hydrolyzed dextrin preparation is especially effective in protecting the animals both against the effects of radiation sickness and against transplanted tumors. The partial hydrolysis did not affect the ability of the material to react with properdin. Further studies of this promising material are recommended. (TTT)

30307 INFLUENCE OF PREVIOUS IMMUNIZATION WITH LIVING AND DEAD E. COLI CELLS ON THE RADIATION RESISTANCE OF ANIMALS. N. N. Klemparskaya and N. V. Raeva. Radiobiologiya, 2: 134-41(1962). (In Russian)

It was previously established that vaccination of animals with bacterial antigens increases their resistance to subsequent radiation by lethal doses of x and γ radiation. Before this method can be put to practical use, the behavior of the various vaccines must be known, and the optimum conditions must be determined. Such experiments were carried out on various animals, using Breslau bacteria killed by heating, BCG vaccine, and live culture of E. Coli for immunization. The animals were exposed to 500 r of x rays. The results indicated that vaccination prior to irradiation increases the resistance of mice, guinea pigs, rabbits, and dogs, as shown by the lengthening of their average life span and by the reduction of the severity of the clinical symptoms. This beneficial effect of vaccination is not connected with antimicrobeal immunity and may be due to the formation of antibodies against the decay products in the tissue. (TTT)

30308 BENEFICIAL EFFECT OF THE SHIELDING OF NONHOMOPOIETIC ORGANS ON THE RESTORATION OF HEMATOPOIESIS IN IRRADIATED MICE. N. F. Barakina (Severtsov Inst. of Animal Morphology, Moscow). Radiobiologiya, 2: 142-7(1962). (In Russian)

In a given dose range, the outcome of radiation sickness depends mostly on the status of the blood circulatory system. This can be improved by introducing intact hematopoietic cells into irradiated animals. It was considered of interest to study the effect of other organs; thus the influence of unirradiated intestines on the hematopoiesis disturbed by exposure to radiation was investigated. The intestines of the mice were shielded by a lead foil, exposing the animals to 700 r of x rays. The results indicated that shielding of the intestines contributes considerably to regeneration of the bone marrow and the spleen. Restoration of the blood circulatory system damaged by radiation is not due to the migration and metaplasia of the shielded lymphatic elements but to the presence of humoral factors in the mucous membrane of the intestines which are able to reactivate the hematopoiesis. (TTT)

30309 STUDY OF THE RADIATION-PROTECTIVE ACTION OF SOME PROTECTIVE MATERIALS ON PROTOZOA. E. Ya. Graevskiĭ, I. V. Nekrasova, and A. I. Shul'mina (Severtsov Inst. of Animal Morphology, Moscow). Radiobiologiya, 2: 148-55(1962). (In Russian)

The behavior of thiourea derivatives as protective agents during the irradiation of protozoa were investigated together with heroin which possesses a known ability of reducing the radiation reaction of tissues in aqueous solution. It was attempted to determine the effect of toxicity of the radiolytic products and of the medium itself. Cultures of Paramaecium caudatum were used for determining the ef-

fect of aminoethylisothiuronium bromide hydrobromide, cysteine amine, cystine amine, and heroin. The H_2O_2 formed during the radiolysis was determined by titration with $KMnO_4$. After exposure of the protozoa to 100 kr, a protective action was noted by the aminoethylisothiuronium bromide hydrobromide and cystine amine. The lack of efficiency of the cysteine amine is due to its decomposition by radiolysis. (TTT)

30310 RADIOPROTECTIVE ACTION OF 5-METHOXY TRYPTAMINE AND OTHER ALCOXY-TRYPTAMINES. I. G. Krasnykh, P. G. Zherebchenko, V. S. Murashova, N. N. Suvorov, N. P. Sorokina, and V. S. Shashkov. Radiobiologiya, 2: 156-60(1962). (In Russian)

The compound 5-oxytryptamine is considered by many as the best agent for protecting animals against the effects of radiation but its unfavorable pharmacological properties prevent its use. For this reason, the following derivatives of the original compounds were prepared: 4-methoxy tryptamine; 5-, 6-, and 7-methoxy tryptamine; and also the 5 ethoxy-, 5-butoxy-, and the 5-benzoxy-tryptamine. White mice and rats were injected with the test compounds and were exposed to x radiation. Results showed that introduction of the methoxy group in the 5 position into the indol ring of the tryptamine enhances noticeably the protective action of the original compound against radiation; the derivative in the 4 position affects the survival rate to a lesser extent; the 6 derivative showed only a slight effect while the 7 derivative was completely ineffective. Lengthening of the C chain in the 5 position resulted in an increase of the toxicity. (TTT)

CHEMISTRY

General and Miscellaneous

30311 (AGN-AN-676) HYDRAZINE PROCESS DEVELOPMENT. Interim Technical Engineering Report May through July 1962. R. L. Pearson, F. R. Standerfer, H. J. Snyder, H. T. Watanabe, L. G. Carpenter, and R. I. Miller (Aerojet-General Nucleonics, San Ramon, Calif.). Contract AF33(600)-42996. 173p. (ASD-TR-7-840A(VI))

Activities in a program to develop, design, construct, and operate a continuous, in-reactor, hydrazine production loop based on the fissio-chemical process approach are reported. Descriptions are included concerning the gas disengager, evaporator, materials test loop, and slurry capsule tests. The use of evaporation, distillation, and molecular sieves as hydrazine-ammonia separation techniques is described. Design of support systems for the in-reactor loop is presented. The fissio-chemical production of UF_3 is reported. Gas disengager test results show that a unit small enough to fit into the in-reactor loop will function well. Evaporative and molecular sieve separation experiments began; a distillation column was designed to concentrate the in-reactor loop product stream. Hydrazine was separated from a crude, radioactive product with a fission fragment decontamination factor of about 10^5. Materials test loop operations showed that slurry-free, ammonia-hydrazine solutions were stable for up to 180 hours; that adding urania particles causes slow hydrazine decomposition; and that mechanical break-up of urania particles occurs. Slurry irradiation capsules were made and tested; irradiations to fuel burnups of 0.005, 0.01, and 0.03% began. Ammonia make-up, loop clean-up, demineralized water, and hydrogen removal systems are being designed to support in-reactor loop operations. An experiment was devised to allow the power level and distribution in the flux region of the loop to be predicted. The MSA Whitby and electron microscopy methods of particle size analysis were modified. A two-column, gas chromatograph was developed for analyzing H_2 and N_2 in the presence of ammonia vapor. UV absorption spectra proved unsuccessful as a hydrazine analytical technique; a constant-current, coulometric method is being investigated. Photobleaching, radical scavenging, and N^{15}-labeled hydrazine techniques will be used to delineate mechanisms of hydrazine formation. Uranyl-8-hydroxyquinolate, initially soluble in ammonia, undergoes slow ammonalysis to an insoluble product. Fission fragment energy deposition efficiencies of thin plate, U-Al sources were determined with the solid-state detection device. A high-energy oxidizer, NF_3, was produced with a G-value of about 0.5 by the fissio-chemical irradiation of an N_2-F_2 gaseous mixture. Heat transfer and viscosity measurement loops were essentially completed. (auth)

30312 SPECTROPHOTOMETRIC STUDIES OF 2,5-DIHYDROXYBENZOIC ACID AND ITS COMPLEX WITH URANIUM. V. Antonijević and M. Pravica. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13: No. 2, 65-73 (July 1962). (In English)

The absorption spectra of 2,5-dihydroxybenzoic acid and its complex compound with uranium are given. The constitution of the complex is determined by the method of continuous variation, and the charge of the complex ion is determined by electromigration. (auth)

30313 SYNTHESIS OF CARBON-14 LABELED DEOXYRIBONUCLEOSIDES. D. L. Williams (Los Alamos Scientific Lab., N. Mex.). Can. J. Chem., 40: 1742-5(Sept. 1962). (LADC-5345)

The enzymatic transfer of deoxyribose from a purine or a pyrimidine deoxyriboside to a carbon-14-labeled purine or pyrimidine base affords an efficient means of preparing labeled deoxyribonucleosides. Deoxyadenosine-8-C^{14}, deoxyguanosine-8-C^{14}, deoxycytidine-2-C^{14}, and thymidine-2-C^{14}, with the natural β-configuration, were prepared in good yields and isolated in radiochemically pure form by large-scale paper chromatography. (auth)

30314 THE ISOTOPIC EXCHANGE OF GASEOUS HYDROGEN WITH LIQUID ALIPHATIC AMINES. PART II. Kedma Bar-Eli and Fritz S. Klein (Weizmann Inst. of Science, Rehovoth, Israel). J. Chem. Soc., 3083-8(Aug. 1962).

The rates of exchange of deuterium, deuterium hydride, and tritium hydride with methyl-, dimethyl-, and ethylamine in the presence of lithium, sodium, and potassium amide were measured. An energy of activation of 3.6 kcal/mole was found for these reactions, to be compared to 7.6 kcal/mole for the exchange with ammonia. As in the exchange of deuterium with water, the exchange with methanol is catalyzed by methoxide ion; the energy of activation is 23.8 kcal/mole, the same as for the exchange with water. The measured rates of exchange, energies of activation, and activities of the different catalysts confirmed the assumption that the catalyst molecule initiates the exchange by a rate-determining association with a deuterium molecule, and that transfer of a hydrogen atom from a solvent molecule to the complex concludes the exchange. (auth)

30315 THE DISTRIBUTION OF HEXAVALENT URANIUM AND TETRAVALENT THORIUM BETWEEN ALCOHOL–NITRIC ACID SOLUTIONS AND THE STRONGLY ACIDIC CATION EXCHANGER DOWEX-50. SEPARATION OF URANIUM FROM THORIUM. J. Korkisch and F. Tera (Univ. of Vienna). J. Chromatog., 8: 516-21(Aug. 1962). (In English)

A study was made of the adsorption behavior of uranium and thorium on the strongly acidic cation exchange resin Dowex-50 in alcohol-nitric acid mixtures. Equilibrium studies showed that both uranium and thorium are strongly adsorbed on this resin from solutions containing a high percentage of aliphatic alcohol. Based on these results, some theoretical explanations of the adsorption behavior of uranium and thorium could be given, and a method was developed for the quantitative separation of uranium and thorium by means of a column operation. (auth)

30316 A NOTE ON THE USE OF PARTIALLY-OVERLOADED β-RAY IONIZATION DETECTORS IN GAS CHROMATOGRAPHY. R. P. A. Sims (Canada Department of Agriculture, Ottawa). J. Chromatog., 8: 538-40(Aug. 1962). (In English)

In the gas chromatographic analysis of the fatty acid composition of seeds with a Sr^{90} ionization detector, unsymmetrical peaks appeared in the chromatographs. The area of the unsymmetrical areas were estimated by triangulation, and the results show that, if allowance is made for detector overloading, the mode of area calculation does not affect the results. (D.L.C.)

30317 THE APPLICATION OF LIQUID ION-EXCHANGE RESINS IN ANALYSIS. PART II. THE REACTIONS OF ZIRCONIUM, TITANIUM AND VANADIUM IN SULPHURIC ACID MEDIA. H. Green (British Cast Iron Research Assn.). Metallurgia, 66: 52-4(July 1962).

With the advent of liquid ion-exchange resins which are insoluble in water but soluble in organic solvents, it is now possible to remove ions from solutions by solvent extraction techniques using ion exchange. In Part I, the results were given of an investigation into the degree of extraction obtained with a liquid anion-exchange resin in the case of iron in various concentrations of mineral acids. Part II deals with the reactions of zirconium, titanium, and vanadium in sulfuric acid, and the effect of the presence of various complexing ions in the solution before extraction is made. (auth)

30318 PROCESS FOR THE PRODUCTION OF ZIRCONIUM OXIDE. Irvin Charles Klimaszewski (to Columbia-National Corp.). British Patent 905,696. Sept. 12, 1962.

A process is given for producing high bulk density zirconium oxide which can be chlorinated in fluidized beds. The process comprises heating a slurry of zirconyl nitrate for ≥10 hr at ≥125°F, separating the water from the slurry to form a thixotropic mixture of water and zirconyl nitrate, and calcining the mixture to form zirconium oxide. (D.L.C.)

30319 IMPROVEMENTS RELATING TO THORIA SOLS. Wayne Thomas Barrett, Moises Gali Sanchez, and Milton Charles Vanik (to W. R. Grace and Co.). British Patent 905,920. Sept. 12, 1962.

A process is given for preparing clad thoria sols which are stable at the high temperatures encountered in reactors. The sol particles have a surface layer of silica which imparts a negative charge to the particles, and the sol is at a pH of 7.0 to 11.0. The process comprises rapidly mixing a sol of spheroidal thoria particles with a freshly prepared silica sol without allowing the mixture to remain at the isoelectric point for any time, and then adding sufficient base to bring the pH to the required value. (D.L.C.)

30320 REMOVAL OF BORON FROM CARBONACEOUS MATERIALS. Charlie Mills Cawley (to United Kingdom Atomic Energy Authority). British Patent 906,341. Sept. 19, 1962.

A simple process is given for reducing the boron content of coal, coal tar, pitch, coke, and other carbonaceous materials. The process comprises heating the material with a lower alcohol (preferably methyl alcohol) and with or without acid, and removing the alcohol and boron together by distillation. (D.L.C.)

30321 METHOD OF PRODUCING A STABLE COAGEL OF AN ALKALINE EARTH FLUORIDE. Sjerp Anne Troelstra (to North American Philips Co., Inc.). U. S. Patent 3,051,659. Aug. 28, 1962.

A method is given for producing stable coagels of MgF_2, CaF_2, SrF_2, and BaF_2. The method comprises the steps of forming a dispersion of the fluoride in water, increasing the surface charge on the dispersed particles by addition of a solution of a potential-determining salt, and adding a coagulating solution to produce a gel containing 50 to 98 vol % water. In many instances, the chloride of the alkaline earth metal can be used both as the potential-determining salt and as the coagulant. Examples are given. (D.L.C.)

30322 PHOTOPOLYMERIZATION OF VINYL MONOMERS BY MEANS OF A MIXTURE OF SILVER COMPOUNDS AS CATALYSTS. Steven Levinos (to General Aniline and Film Corp.). U. S. Patent 3,053,745. Sept. 11, 1962.

The photopolymerization of vinyl compounds with a silver compound catalyst can be greatly increased if the catalyst is a mixture of an insoluble silver halide and a silver salt with a water solubility greater than that of the halide. The catalytic activity of the mixture may also be promoted by means of small amounts of an amphoteric metal oxide and an optical sensitizing dye. A crosslinking agent with at least two terminal vinyl groups may be used to increase the molecular weight of the vinyl polymers. (D.L.C.)

Analytical Procedures

Refer also to abstracts 30183, 30606, and 31306.

30323 (DP-751) NORMALIZING GAMMA SPECTRA FOR DATA PROCESSING. Robert F. Overman (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Aug. 1962. Contract AT(07-2)-1. 9p.

A method was devised to resolve gamma spectral data that are derived from a multichannel analyzer on a routine basis. This method of computation compensates for any change of gain in the electronic system. (auth)

30324 (GAT-T-828) STABILIZED PLASMA JET FOR SPECTRAL EXCITATION OF UF_6. Louis E. Owen (Goodyear Atomic Corp., Portsmouth, Ohio). Sept. 12, 1960. Contract AT-(33-2)-1. 9p.

A plasma jet for exciting gaseous UF_6 was designed as a component in emission spectroscopic analytical systems for the isotopic assay of uranium. An external tungsten electrode eliminated the wandering arc streamer which made electrical connection from the "flame" to the cathode electrode in the original design. Construction, operation, and controls are discussed. (M.C.G.)

30325 (HW-73972) THE SEQUENTIAL SEPARATION AND DETERMINATION OF ARSENIC-76 AND PHOSPHOROUS-32 IN REACTOR EFFLUENT WATER. W. C. Johnson, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 12, 1962. Contract AT(45-1)-1350. 12p.

A procedure for the sequential separation and determination of Arsenic-76 and Phosphorous-32 in reactor effluent water is described. The analysis can be performed in less than one hour and the arsenic fraction is scanned immediately after separation on a multi-channel gamma spectrometer. The discrete gamma energy of 0.56 Mev for Arsenic-76 makes further purification unnecessary. The organic phase containing Phosphorous-32 is dry mounted on a one-inch stainless steel dish for beta counting. (auth)

30326 (HW-SA-2635) APPLICATIONS OF CONTROLLED POTENTIAL COULOMETRY. W. L. Delvin and L. R. Duncan (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 25, 1962. Contract AT(45-1)-1350. 8p.

The broad capability of controlled potential coulometry is shown by reviewing analytical methods for radioactive and non-radioactive materials. In essence, controlled potential coulometry is the titration of an ion by electrically reducing or oxidizing it at a controlled potential. Methods are given for the coulometric determination of plutonium, uranium, iron, lead, nitrate, gold, cadmium, copper, thallium, and neptunium. (N.W.R.)

30327 (IDO-14588) ANNUAL REPORT OF ICPP ANALYTICAL SECTION FOR 1961. Ralph C. Shank, et al. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 31, 1962. Contract AT(10-1)-205. 142p.

Information of interest to analytical chemists is presented in a report containing both positive and negative results obtained in a total of 58,467 determinations. The data

and information are presented in sections concerning the work of the shift laboratory, special analysis laboratory, spectral analytical group, analytical development group, quality control and standards laboratory, and analytical service for EOCR. Details of methods added to the ICPP analytical manual, and to the ICPP analytical radiochemical manual are included. (J.R.D.)

30328 (JEN-98-DQ/I-29) DETERMINACIÓN ESPECTROFOTOMÉTRICA DE ALUMINIO EN PRESENCIA DE HIERRO CON ERIOCROMOCIANINA R. ENSAYOS CON UN REACTIVO DECOLORADO. (Spectrophotometric Determination of Aluminium in Presence of Iron with Eriochrome Cyanine R. Essays with a Decolorated Reagent). M. Barrachina Gomez, L. Gasco Sanchez, and R. Fernandez Cellini (Spain. Junta de Energia Nuclear, Madrid). 1962. 13p.

The behavior of the extinction coefficient of aqueous solutions of erichrome cyanine R was studied. It was found that at pH 5 to 6 the diluted acid solutions decolorate rapidly according to an exponential law (538 mμ). The fact that the decolored solutions go on still reacting with the aluminium led to the preparation of a more suitable reagent for spectrophotometric purposes. The experimental results of decoloration of the reagent are interpreted on the basis that the reagent suffers at pH 5 to 6 spontaneous transformation to a more stable form during the first hours. A mathematical expression which fits very well to the experimental data is also given. (auth)

30329 (ORNL-TM-366) ORNL PROCEDURES FOR CONTROLLED-POTENTIAL COULOMETRIC TITRATION OF PLUTONIUM. W. D. Shults (Oak Ridge National Lab., Tenn.). Sept. 14, 1962. Contract [W-7405-eng-26]. 7p.

Six procedures, in stepwise form, that can be used for the determination of plutonium in several forms by controlled-potential coulometric titration are presented. (auth)

30330 (TID-11969) FRACTIONATION OF GASEOUS URANIUM AND URANIUM MONOSULFIDE AT HEATED SURFACES. E. David Cater and R. J. Thorn (Argonne National Lab., Ill.). Dec. 8, 1960. Contract [W-31-109-Eng-38]. 9p. (UAC-4796)

To develop a more quantitative technique for quantitative determination of the species in a molecular beam an attempt was made to fractionate a molecular beam of gaseous uranium, sulfur, and uranium monosulfide by impinging the beam on tungsten collectors which were heated to temperatures ranging from 400 to 1700°C. The amounts of uranium condensing on the heated collectors were determined by α-counting. A plot of the amount of condensate vs. temperature of collectors showed two distinct plateaus corresponding to the condensation of uranium plus monosulfide and the condensation of uranium monosulfide alone. By combining these observations with the previously reported mass spectrometric study one can calculate relative ionization-detection ratios for uranium-to-monosulfide. This procedure permits more accurate determination of thermodynamic properties of effusing gases than was possible heretofore. The potential uses of the technique and its application to the study of the condensation process are discussed. (auth)

30331 (UWFL-52(Rev.)) A METHOD FOR THE DETERMINATION OF STRONTIUM-90 IN BIOLOGICAL MATERIALS. Toshiharu Kawabata and Edward E. Held (Washington. Univ., Seattle. Applied Fisheries Lab.). Jan. 2, 1958. Contract AT(45-1)-540. 10p.

A method is described for the determination of Sr^{90} in biological materials. The method is a combination of the nitric acid precipitation and ion exchange techniques and depends on the separation of Y^{90} rather than the complete separation of Sr. (C.H.)

30332 (WAL-TR-823/5) A BASIC STUDY OF VACUUM-FUSION ANALYSIS OF REFRACTORY METALS FOR GASES. Final Report. M. W. Mallett, D. F. Kohler, R. B. Iden, and B. G. Koehl (Battelle Memorial Inst., Columbus, Ohio). May 1962. Contract DA-33-019-505-ORD-11. 40p.

Various techniques for the determination of oxygen in the refractory metals Nb, Ta, Mo, and W by the vacuum-fusion method are evaluated. The platinum bath at 1900°C and a Pt: M ratio as low as 1:1 is satisfactory for niobium and tantalum. An iron bath at 1650°C and a maximum molybdenum or tungsten content of 30% is recommended for molybdenum and tungsten. Hydrogen absorption by a Hopcalite-Ascarite mixture was shown. This leads to some error in oxygen analyses made with this absorbent. The use of a gas chromatograph and internal gas standard for analysis of vacuum-fusion gases was demonstrated. Several phase diagrams pertinent to the vacuum-fusion analysis of the 4 metals are given. (auth)

30333 (AEC-tr-5222) SPECTROPHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF SULFATE ION. [PARTS] I–III. Iwaji Iwasaki, Satori Utsumi, Ken Hagino, Toshikazu, and Takejiro Ozawa. Translated from Nippon Kagaku Zasshi, 79: 32-50(1958). 49p.

Experiments were performed on the indirect colorimetric determination of sulfate ions using barium chromate. In the solid method, a buffer solution and alcohol are added to the sample solution, and a fixed amount of solid sample of barium chromate is stirred in with the formation of chromate ions. After separation by centrifuging and filtration, the filtrate is colored by addition of diphenylcarbazide and hydrochloric acid. Sulfate ions were determined by measuring the degree of absorption at 545 mμ. The method can be applied rapidly and accurately to 0.2 ~ 12 ppm of SO_4^{2-}, but only with difficulty to higher concentration. In the solution method, a solution of barium chromate in hydrochloric acid is added to the sample solution to form barium sulfate. Then ammonium and alcohol are added so that the excess of barium precipitates as barium chromate and can be subsequently removed by filtration. Sulfate ions are determined by measuring chromate ions in the filtrate directly or indirectly after coloring by addition of diphenylcarbazide. The method is susceptible to various influences and has rather poor reproducibility, but it is suitable for the determination of a relatively high concentration. (auth)

30334 THE ISOTOPIC ANALYSIS OF LITHIUM ON A MASS SPECTROMETER. J. Pupezin, M. Čirić, and D. Lazarević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13: No. 2, 77-83(July 1962). (In English)

A precise isotopic analysis of microgram amounts of lithium was made with a triple-filament surface-ionization ion source. On a single-collector mass spectrometer the Li^7/Li^6 ratio was determined with a standard error of 0.2 to 0.3%. On a double-collector spectrometer, relative measurements of the isotopic constitution were made, with a standard error of about 0.1%. (auth)

30335 MICRO-DETERMINATION OF ALUMINUM IN POLYETHYLENE BY NEUTRON ACTIVATION FOLLOWED BY γ-RAY SPECTROMETRY. Toshi Nakai and Minoru Okada. Dōitai to Hōshasen, 4: 66-7(May 1961).

A method for determining trace amounts of Al in polyethylene is described. A sample (1-2 g) was sealed in a polyethylene capsule (1.7 cm dia and 3 cm high) and irra-

diated at a neutron flux of 4×10^{10} n/cm^2/sec for 2.5 min. The sample was transferred to a fresh capsule after 1 min of cooling and then counted for 1 min. It was cooled again for 10 sec and counted for another min. The counter used was a RCL-256-channel pulse height analyzer attached to a 2-in. thick, well-type, Tl-activated NaI crystal. The analyses of the spectrograms showed that the Al interferences were negligible. (OID)

30336 THE EXTRACTION OF TECHNETIUM-99 BY ACETONE. A. F. Kuzina, T. S. Tagil', N. N. Zamoshnikova, and Vikt. I. Spitsyn. Doklady Akad. Nauk S.S.S.R., 145: 106-8(July 1, 1962). (In Russian)

The literature data shows that Tc^{99} is readily extracted by ketones such as methylethylketone and methylisobutylketone. Acetone also should extract Tc^{99} well, but it suffers from the disadvantage of being completely miscible with water. It was found that 2 to 6N NaOH salts out the acetone with the formation of two phases. The distribution coefficient for Tc^{99} varies from 3 in 2N NaOH to 10 in 6N NaOH at an initial technetium concentration of 10.2 mg Tc^{99} per liter in the aqueous phase. This method was used to isolate small amounts of Tc^{99} from a large amount of Mo metal or MoO_3 irradiated by neutrons in a pile. The presence of up to 75 g/l of Na_2MoO_4 did not interfere with the extraction. After evaporating off the acetone, Tc^{99} was precipitated as the pentasulfide. The Tc^{99} isolated was found to be radiochemically pure. (TTT)

30337 ACTIVATION ANALYSIS OF ZONE-REFINED GOLD. F. Cattaneo (CISE, Milan), E. Germagnoli, and G. Schiavini. Energia nucleare (Milan), 9: 467-71(Aug. 1962). (In English)

Zone-melting refinement of commercially pure gold is described. The achieved purification is estimated by means of activation analysis. (auth)

30338 CONDUCTOMETRIC METHOD FOR THE ESTIMATION OF CARBON IN PURE URANIUM METAL. K. G. Divekar, K. A. Khasgiwale, T. P. Ramachandran, and M. Sundaresan (Atomic Energy Establishment, Trombay, India). J. Sci. Ind. Research (India), 21B: 418-21(1962). (In English)

The conductometric method for the estimation of carbon in uranium metal was studied in the range of 50-1200 μg of carbon. The standard deviation is better than ±4 and ±7% in the range of 1200-300 and 300-50 μg of carbon respectively. In the estimations, 0.5-2.0 g of uranium metal sample is used for analysis and carbon standards are prepared from quartz-sucrose mixture. (auth)

30339 ABSOLUTE MEASUREMENT OF SULFUR-35. Tamaki Watanabe (Japan Atomic Energy Research Inst., Tokyo. Nippon Genshiryoku Gakkaishi, 4: 435-9(July 1962). (In Japanese)

In measuring the absolute activity of soft-β emitters such as S^{35}, the main error arises from self-absorption of β radiation by the source. A method of preparing a S^{35} source having only slight self-absorption, and of estimating the self-absorption of this source, is discussed. The source preparation procedure is as follows: the sample solution, sulfuric acid in dilute hydrochloric acid solution, is dropped onto a thin vinyl film and dried on a dessicant; this source is then dissolved with redistilled water and again dried up in an ammoniac atmosphere. Nb^{95}, which emits a β particle with the same maximum and mean energy as that emitted by S^{35} and also emits a prompt γ ray, is also studied. Crystal sizes in the Nb^{95} source are compared with those in the S^{35} source microscopically. Self-absorption in the Nb^{95} source is measured by determinations of the ratio of β counting rate/β-γ coincidence counting rate in a 4π geometry. The amount of self-absorption in sources prepared by the method described ranges from 2 to 5%. (auth)

30340 DETERMINATION OF FLUORIDE IN URANIUM ORE CONCENTRATES. Nuclear Energy, 356-7(Sept. 1962).

A solution of the sample in sulfuric acid is steam distilled. The fluoride is collected in sodium hydroxide solution and is determined by titration with thorium nitrate solution. This method covers the range 100 to 1000 ppm fluorine but could be extended by taking a smaller aliquot of the distillate. At the 1000 ppm level, the standard deviation is ±60 ppm. (auth)

30341 DETERMINATION OF URANIUM IN AQUEOUS EFFLUENTS. Nuclear Energy, 364(Sept. 1962).

A sample of the effluent is evaporated to low bulk and uranium extracted from the solution with tributyl phosphate–isooctane reagent. Uranium in the organic extract is then determined absorptiometrically as the dibenzoylmethane complex. (auth)

30342 A STUDY OF THE EFFECT OF Ti, Th AND Zr ON THE ACCURACY OF SPECTRAL DETERMINATION OF SMALL URANIUM QUANTITIES. T. M. Moroshkina. Vestnik Leningrad. Univ., No. 10, Ser. Fiz. i Khim., No. 2, 152-6(1962). (In Russian)

Effects of Ti, Th, and Zr on the spectral determination of uranium was studied. It has been shown that Ti, Th, and Zr decrease the relative intensity of certain uranium and molybdenum lines. The detection of uranium in the presence of these elements is possible at uranium concentrations from 0.02% and higher. (auth)

30343 DETERMINATION OF ZIRCONIUM IN Nb AND Nb_2O_5. V. A. Nazarenko and E. N. Poluektova (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Zavodskaya Lab., 28: 656-8(1962). (In Russian)

Separation of Zr from Nb and Nb_2O_5 by potassium hydroxide in hydrogen peroxide and photometric phenylfluoronone (with 0.25 n HCl and ~30% C_2H_5OH) is described. Optical density is measured at 535mμ. (tr-auth)

30344 CHEMICO-SPECTRAL METHOD OF BORON DETERMINATION IN SILICON AND ITS COMPOUNDS. L. S. Vasilevskaya, A. I. Kondrashina, and G. G. Shifrina (State Scientific-Research and Technological Inst. of Rare Metals, USSR). Zavodskaya Lab., 28: 674-6(1962). (In Russian)

The spectral determination of boron in a silicon concentrate by separating silicon as tetrafluoride and combining mannite with boron as a low-volatility complex compound is suggested. The sensitivity of the method is 10^{-6} to 5×10^{-1}%. (R.V.J.)

30345 SPECTRO-CHEMICAL DETERMINATION OF BORON IN HIGH-PURITY SILICON TETRACHLORIDE. A. F. Pehelintseva, N. A. Rakov, and N. P. Slyusareva. Zavodskaya Lab., 28: 677-8(1962). (In Russian)

Concentration of boron in high-purity silicon tetrachloride by forming an unsoluble triphenylchloromethane complex and evaporating silicon chloride is described. The method is capable of determining 10^{-2} to 4×10^{-1}% B. (tr-auth)

30346 COLORIMETRIC DETERMINATION OF Be WITH ALUMINON IN NIOBIUM BASE ALLOYS. B. S. Tsyvina and M. B. Ogareva (State Scientific-Research Technological Inst., USSR). Zavodskaya Lab., 28: 917-19(1962). (In Russian)

Colorimetric determination of Be in reaction with aluminon (ammonium aurintricarboxylic acid) in niobium

base alloys is suggested by adding tartaric acid for retaining niobium in the solution. Effects of admixtures on Be determination in 100 mg of complexon and 10 ml of niobium tartrate containing 1 mg/ml Nb were also determined. (R.V.J.)

30347 COLORIMETRIC DETERMINATION OF BERYLLIUM IN BRONZE BY ALUMINON. L. P. Adamovich and B. V. Yutsis (Khar'kov State Univ.). Zavodskaya Lab., 28: 920-1(1962). (In Russian)

The optical density of beryllium–aluminon (ammonium aurintricarboxylic acid) formed at pH = 4.4 ± 0.05 was determined. Copper was masked by the complexon. The relative order of error is ±1.52. (R.V.J.)

30348 CHEMICO-SPECTRAL METHOD OF DETERMINING Nb IN ORES AND FINISHED PRODUCTS. L. E. Berenshtein (Central Scientific Research Inst. of Mining of Non-Ferrous and Precious Metals, USSR). Zavodskaya Lab., 28: 940-1(1962). (In Russian)

A method was developed for determining Nb in ores by dissolution following calcination with $(NH_4)_2SO_4 + H_2SO_4$ and leaching by tartaric acid. The treatment is culminated by spectral analysis with $\sigma_{21} \approx 6.1\%$. (tr-auth)

30349 NONDESTRUCTIVE FUEL ASSAY—WITH EMPHASIS ON SCINTILLATION SPECTROMETRY. N. S. Beyer (Argonne National Lab., Ill.). Preprint Paper No. 23. New York, Engineers Joint Council, 1962. 22p.

The theoretical basis for γ scintillation spectrometry techniques, the types of detection apparatus used, and application of the techniques to assay of reactor fuel elements are described. X-ray fluorescence spectrometry, reactor danger coefficient analysis, and radiographic densitometry studies are discussed briefly. (A.G.W.)

30350 THE APPLICATION OF CHARACTERISTIC X-RAYS EXCITED BY β-PARTICLES TO THE ANALYSIS OF THE COMPOSITION OF METALS. E. Zarzecka. 8p. of "Pierwsze Krajowe Sympozjum Zastosowań Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

The application of β-ray sources instead of x-ray gages and scintillation or proportional counters instead of crystal spectrometers to fluorescent x-ray spectroscopy permits the lowering of the intensity of exciting sources by several orders of magnitude. Possible β sources and radiation detectors, their advantages and application ranges are discussed. The method permits the application of β-excited fluorescent x rays for analyzing segregation in high alloy steels. (OID)

30351 IMPROVEMENTS IN MEANS FOR THE QUANTITATIVE ANALYSIS OF DEUTERIUM IN HYDROGENATED COMPOUNDS. Guy Nief and Rene Botter (to Commissariat á l'Énergie Atomique). British Patent 904,165. Aug. 22, 1962.

A process and an apparatus are described for accurate analysis of D_2 in hydrogen-containing compounds. In this process, the compound is changed into the gaseous phase and reduced in a heated uranium oven to produce free D_2 and H_2, and the free gases are passed to a mass spectrometer. The uranium is in the form of tapes maintained at 570 to 630°C in a U-shaped silica tube. The process is applicable to concentrations of 0 to 10^4 ppm D_2 in H_2. (D.L.C.)

30352 ION SOURCES AND DETECTORS FOR THE MASS SPECTROSCOPIC ANALYSIS OF SOLIDS. Leonard F. Herzog (Pennsylvania State Univ., University Park and Nuclide Analysis Associates, State College, Penna.) Donald J. Marshall, Bruce R. F. Kendall, and Leslie A. Cambey. Prepublication Copy. 66p.

The mass spectroscopic analysis of solids has proceeded thus far largely by the adaptation of the first-order double-focusing, r-f spark source, photographic plate detector mass spectrograph which was developed in the 1930's for atomic mass difference determinations. Instruments of this type have proven their usefulness in chemical analyses and, particularly, in studies of trace constituents below 1 ppm. There are other sources and detectors useful in other areas of mass spectroscopic analyses. Some offer compelling advantages over the r-f spark source, photographic plate instrument for certain problems encountered in the analysis of solids. Several of these sources and detectors are described and discussed. The sources mentioned include: electron bombardment, crucible, arc-image, laser, thermionic, vacuum vibrator, d-c, hot spark, ion bombardment (sputtering), and field emission type. The detectors mentioned include: the Faraday cup, electron multipliers of various types, scintillation and photomultiplier types, semiconductors, and various combinations and arrays of the above, used with amplifiers or pulse-counting equipment. Some electronic circuits useful with electrical detection are also discussed. There are the Kendall resolving power multiplier, the intensity ratio circuit, and the synchronous pulsed source and detector system. (auth)

30353 SODIUM AND MAGNESIUM FLUORESCENCE ANALYSIS. PART II. APPLICATION TO SILICATES. A. K. Baird, D. B. McIntyre, and E. E. Welday (Pomona Coll., Claremont, Calif.). 26p.

To be published in Advances in X-Ray Analysis, Vol. 6, Plenum Press, New York.

Moderate counting rates, in excess of 400 cps at a signal/noise of 18 on 3.5% Na_2O in rocks, permit high precision quantitative analysis for light elements in silicates. Special advantages of fluorescence analysis in the 10Å region, with adequate excitation provided by an Al target tube, are described. These advantages include an ease of discrimination by excitation potential and by high dispersion using large 2d space crystals. Minor and simple modifications of the optic path combined with electronic discrimination make the method ideal for Na and Mg. Routine runs over periods of days were made possible by a new technique of calibration involving computer corrections for systematic drift from any source. Repeated tests show that the total analytical error, including specimen preparation, closely approaches that of the counting statistics used, and that the drift corrections are complete. In granitic rock analyses resulting precisions are 1% for 2-5% Na_2O and 2% for 0.25-1.0% MgO. (auth)

General Inorganic and Physical Chemistry

30354 (AEET/CD/6) ELECTROLYTIC URANIUM TETRAFLUORIDE. S. D. Gokhale and S. Jayaraman (India. Atomic Energy Establishment, Trombay). 1962. 20p.

Studies concerning the reduction of ammonium uranyl fluoride complexes to uranium fluoride by electrolysis are reported. The use of an Hg-amalgamated revolving metallic electrode allowed continuous reduction of the complex. A cell is described in which the U concentration in solution was reduced to 0.049 M after a 7½-hr electrolysis. The efficiency of the reduction was 90%. (J.R.D.)

30355 (AEET/CD/7) STUDIES IN ELECTROLYTIC REDUCTION OF URANIUM(VI) IN ALKALINE MEDIA. A. D. Damodaran and S. D. Gokhale (India. Atomic Energy Establishment, Trombay). 1962. 11p.

Results of an investigation aimed at obtaining pure UO_2

directly from a uranyl carbonate complex are reported. Experimental results obtained by using ammonium uranyl carbonate electrolyte solution indicate that a current density of 2.9 amp/dm^2 and a stirrer speed of about 150 rpm are optimum. (J.R.D.)

30356 (BM-RI-6033) HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF SESQUIOXIDES OF EUROPIUM, GADOLINIUM, NEODYMIUM, SAMARIUM, AND YTTRIUM. L. B. Pankratz, E. G. King, and K. K. Kelley (Bureau of Mines, Berkeley, Calif.). Dec. 1961. 21p.

Results of high-temperature heat content measurements on sesquioxides of 4 rare earth elements, Eu, Gd, Nb, and Sm, and the closely related element, Y, at 298 to 1802°K are reported. The original heat content data and smooth values are included, together with smooth entropy increment data above 298.15°K. Equations representing the heat content results were derived and are included. It is indicated from the observations that the cubic varieties of the sesquioxides of Eu, Gd, and Sm are unstable with respect to the monoclinic varieties, and that the conversion of cubic to monoclinic is irreversible. The sesquioxides of Gd and Y have about the same average heat capacity for the measured temperature range, from 298 to 1800°K, and this value is lower than for any of the other 3 sesquioxides. For the same temperature range, the other sesquioxides have average heat capacities that increase in the order Nd-Sm-Eu. (P.C.H.)

30357 (BNL-6231) CHEMISTRY OF ANHYDROUS SYSTEMS CONTAINING HYDROGEN FLUORIDE AND NITROGEN OXIDES. Frederick L. Horn, Charles B. Bartlett, and Richard J. Tivers (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract [AT-30-2-GEN-16]. 10p.

Nitrosyl and fluoride ions are formed in liquid anhydrous hydrogen fluoride when nitric oxide, nitrogen sesquioxide, nitrogen tetroxide, or nitrosyl fluoride, are dissolved. Vapor infrared analysis was used to study the solution composition and gaseous reaction products. These solutions react with metallic uranium, plutonium, zirconium, iron, and aluminum, as well as ceramic uranium oxide and uranium carbide, forming soluble nitrosyl metal fluoride complexes and liberating nitric oxide. The uranium compound identified as nitrosylium hexafluorouranate, $NOUF_6$, was made volatile by passing nitrosyl fluoride gas over the dry salt at 500°C. (auth)

30358 (EURAEC-178) GROWTH OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 1, July–September 1961. (Brussels. Centre d'Étude de l'Énergie Nucléaire). Oct. 1961. Work Performed under United States–Euratom Joint Research and Development Program. Contract 055-61-7RDB. 15p.

The improvement of a simple method for growing single crystals of UO_2 from the vapor was investigated. The method consists mainly in sublimation of UO_2 from the interior of a cylinder of UO_2 and in condensing the vapor on a cooled tungsten foil. Crystals of 12 mm in size were grown. Total impurity content remains in the vicinity of 100 ppm; oxygen analysis showed a very nearly stoichiometric composition expressed by the formula $UO_{2.00014}$. The mechanism of the production of single crystals by the method of fused salt electrolysis is also reported. The average size of the UO_2 crystals obtained on the cathode was 1 mm, with a mass of about 2 mg. (auth)

30359 (EURAEC-297) GROWTH OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 3, January 1–March 31, 1962. (Brussels. Centre d'Étude de l'Énergie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 055-61-7RDB. 4p. (R-2111)

The development of a method for preparing UO_2 single crystals by sublimation is briefly discussed. Single crystals up to 5 g were grown. (P.C.H.)

30360 (EURAEC-302) PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 2, January 1–March 31, 1962. (Brussels. Centre d'Étude de l'Énergie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 063-61-10 RDB I.1.15. 31p. (R-2109)

A satisfactory method for measuring accurately the density of UO_2 single crystals was developed and tested. It makes use of the compound float and water is the immersion liquid. The method for measuring lattice parameters achieves an accuracy of 3×10^{-4} Å. Electrical conductivity measurements were performed on 7 specimens which were nominally stoichiometric. For two, the O/U ratio was determined after the measurements and found to be 2.0077 and 2.0064 with an accuracy of 0.0005. A theoretical analysis was made of the influence of oxygen pressure on the electrical conductivity in uranium oxide. The optical absorption spectrum of uranium oxide single crystals was also measured. (P.C.H.)

30361 (IS-181) THE CRYSTAL STRUCTURE OF $LiCuCl_3 \cdot 2H_2O$. Peter H. Vossos, D. R. Fitzwater, and R. E. Rundle (Ames Lab., Ames, Iowa). Aug. 9, 1960. Contract [W-7405-eng-82]. 24p.

$LiCuCl_3 \cdot 2H_2O$ forms garnet-red, monoclinic crystals, $a = 6.078$, $b = 11.145$, $c = 9.145$Å (all ±0.003), $\beta = 108°50'$, space group $P2_1/c$, $Z = 4$. The structure contains planar $Cu_2Cl_6^{2-}$ ions joined by longer Cu···Cl links to form chains. Oxygen positions were found; half of the water molecules are coordinated to copper. Lithium and hydrogen positions were not revealed by the three-dimensional determination. A final refinement using the Levy-Bussing anisotropic temperature factor treatment and least squares program achieved a discrepancy factor, R, of 10.5% for visually determined intensities. Standard deviations as determined from least squares are about 0.007Å for oxygen parameters, less for others, while important interatomic distances were determined with standard deviations of ~0.0025Å. (auth)

30362 (IS-232) BISMUTH. James S. Fritz (Ames Lab., Ames, Iowa). [Oct. 27, 1960]. Contract [W-7405-eng-82]. 48p.

A review is given on the physical and chemical properties, detection, separation, determination, and the analysis of alloys and ores of bismuth. Various separation and determination methods for bismuth are discussed. 107 references are included. (P.C.H.)

30363 (IS-287) ELECTRON DEFICIENT COMPOUNDS. IX. THE STRUCTURE OF STANNOUS CHLORIDE. R. E. Rundle and D. H. Olson (Ames Lab., Ames, Iowa). [Apr. 14, 1961]. Contract W-7405-eng-82. 7p.

Results of a study on the structure of $SnCl_2$ are presented. Specimens were grown by low pressure sublimation of the dehydrated parent dihydrate. Data and projections of the structure are included. (J.R.D.)

30364 (LADC-5176) SOME THERMODYNAMIC PROPERTIES OF THE ACTINIDE CARBIDES, INCLUDING NEW MEASUREMENTS OF THE HEATS OF FORMATION OF SOME THORIUM, URANIUM AND PLUTONIUM CARBIDES. Elmer J. Huber, Jr. and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 33p.

The present state-of-knowledge about the heats, free energies, and entropies of the carbides of Th, U, and Pu is reviewed, and the experimental measurement of the heats of formation of ThC, U_2C_3, $UC_{1.86}$, and $PuC_{0.77}$ is described. Some detailed calculations leading to estimates of the free energies of formation at different temperatures are appended. (P.C.H.)

30365 (NRL-5844) HIGH TEMPERATURE PROPERTIES OF SODIUM AND POTASSIUM. Seventh Progress Report, April 1–June 30, 1962. C. T. Ewing, J. P. Stone, J. R. Spann, E. W. Steinkuller, T. A. Kovacina, and R. R. Miller (Naval Research Lab., Washington, D. C.). Aug. 23, 1962. 7p.

The status of thermophysical property tests for sodium, potassium, and their vapors, at elevated temperatures is discussed. Preliminary values are reported for the density of liquid potassium from 1564 to 2282°F and for the equilibrium solubility of niobium and zirconium in liquid sodium from 1470 to 2507°F. (auth)

30366 (ORNL-3297) ANALYSIS OF UO_2 DISSOLUTION IN NITRIC ACID SOLUTION. H. F. Johnson (Oak Ridge National Lab., Tenn.). Sept. 18, 1962. Contract W-7405-eng-26. 34p.

A model assuming a zero-order reaction and dependence of specific area, a, on fraction of pellets dissolved, F, is proposed to explain the dissolution of UO_2 pellets in nitric acid solution. A Fortran program for the IBM-7090 was developed to calculate the rate coefficient, ka, and F from experimental data for concentration as a function of time obtained in countercurrent stage runs. Application of the Fortran program to data from eight experimental runs led to fairly good agreement between the ka-vs-F relations for all stages of the eight runs. The average relation for all runs can be represented by a second-order polynomial. From the ka-vs-F polynomial and the zero-order reaction model, an analog computer representation of the multistage dissolution process was developed and applied for conditions of the eight experimental runs. The concentration profiles thus calculated were in very good agreement with the original experimental profiles. The studies covered conditions of initial acid concentrations from 5.5 to 8.0 M and L/V ratios from 0.126 to 0.223 min^{-1}. The model described should be tested with other systems. It is desirable that the sampling time interval be decreased relative to the dissolution rate. Thus for rates of the magnitude studied here, more frequent sampling should be used. However for slower rates, the 10-min interval is probably satisfactory. If intervals other than 10 min are used, the Fortran program will have to be modified. (auth)

30367 (TID-6638) THERMODYNAMICS OF NONSTOICHIOMETRIC SYSTEMS. Robert C. Plumb and Joseph Boggio (Worcester Polytechnic Inst., Mass.). [Sept. 1960]. Contract [AT(30-1)-2479]. 8p.

An analysis is presented in which it is shown that it is possible to separate the chemical potential of an ion into two parts, one associated with the free energy of the species in a stoichiometric material and one giving the contribution to the free energy resulting from the nonstoichiometry. (J.R.D.)

30368 (TID-11021) AQUA REGIA OFF-GASES. Clyde Orr, Jr. and Margaret C. Kordecki (Georgia Inst. of Tech., Atlanta). [1959]. Contract [W-7405-eng-26]. 14p.

The composition and concentration of gases expected to be evolved from boiling aqua regia alone and from aqua regia during stainless steel dissolution were surveyed. When aqua regia was boiled alone, the first gases evolved contained more than 50% Cl_2 by volume. The Cl_2 soon dropped and the concentration of NOCl rose to 80% with traces of NO and NO_2. In stainless steel dissolution, the off-gases contained varying quantities of N_2O, N_2, H_2, and HCl in addition to the gases found with boiling aqua regia alone. (J.R.D.)

30369 (TID-11153) ELECTROPHORETIC DEPOSITION: A VERSATILE COATING METHOD. Conrado P. Gutierrez, John R. Mosley, and Terry C. Wallace (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-Eng-36]. 25p. (LADC-4381)

The technique of electrophoretic deposition was investigated as a method for the formation of coats of various metals, oxides, carbides, and metal plus oxide composites. Comminution of powders for optimum particle size distribution and the choice of suspension medium are discussed. The importance of purity in all components is stressed in the preparation of stable suspensions with satisfactory plating characteristics. The deposition of the following materials is described in detail as examples of the versatility of the electrophoretic coating method: Re, Zr, Mo, UO_2, Nb–UO_2, Mo–UO_2, and ZrC–UC. (auth)

30370 (TID-12048) THE SYSTEM URANIUM–OXYGEN–SULFUR. E. David Cater and Paul W. Gilles (Argonne National Lab., Ill. and Kansas. Univ., Lawrence). Sept. 1960. Contract [W-31-109-Eng-38]. 16p. (UAC-4636)

A schematic phase diagram for the ternary system uranium–oxygen–sulfur is presented. The phase equilibria were determined by x-ray and chemical analysis at room temperature of samples prepared or annealed at high temperatures. The one ternary phase, the oxysulfide heretofore designated UOS, has at least a small composition range such that $O/U \geq 1$ and $O/S \geq 1$. The lattice parameters of tetragonal, sulfur-saturated, perhaps stoichiometric oxysulfide are $a_0 = 3.4828 \pm 0.0002$ and $c_0 = 6.6967 \pm 0.0003$ Å. (auth)

30371 (TID-16693) THE COORDINATION CHEMISTRY OF 3d TRANSITION METAL IONS IN FUSED SALT SOLUTIONS. Dieter M. Gruen and Robert L. McBeth (Argonne National Lab., Ill.). June 1962. Contract [W-31-109-eng-38]. 57p. (UAC-6513)

Spectral data and their interpretation in terms of coördination numbers and configurations of the 3d metal ions in chloride melts are summarized. New insights into the stoichiometry, structure, and stability of complex ions in high temperature solvent systems come from measurements carried out at temperatures up to 1000°C, and extending from the near infrared (4000 cm^{-1}) to the near ultraviolet (3000 cm^{-1}) region of the spectrum. A better understanding of a number of important factors governing coordination numbers and configurations, particularly of chlorocomplexes of transition metal ions, is presented. A detailed discussion of the results is given. (P.C.H.)

30372 (Y-1398) IONIC EQUILIBRIA AND ANION EXCHANGE OF URANYL SULFATE SOLUTIONS. P. E. Stein (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.) June 6, 1962. Contract W-7405-eng-26. 205p.

A theoretical investigation was performed on the nature of ion exchange of acidified uranyl sulfate solutions with Dowex 21K, a strong base ion exchange resin. It was found that the manner of variation of individual uranium specie concentrations with total sulfate concentration is not significantly affected by total uranium concentration in the range 0.0005 to 0.005 molar. Recent experimental ion exchange data were correlated with theoretical solution ionic concentrations for several assumed reaction mechanisms. The similarity of the results obtained suggests that the

method of correlation is not sufficiently sensitive to the different mechanisms to distinguish between them, and/or resin loading is not influenced by the relative concentrations of the different uranium species in solution. (auth)

30373 (AEC-tr-4940) LITHIUM, ITS CHEMISTRY AND TECHNOLOGY. (Litii, ego Khimiya i Tekhnologiya). Yu. I. Ostroushko, P. I. Buchikhin, V. V. Alekseeva, T. F. Naboishchikova, G. A. Kovda, S. A. Shelkova, P. N. Alekseeva, and M. A. Makovetskaya. Translated by Helen Basil (Argonne National Lab., Ill.) from a publication of the Council of Ministers of the U.S.S.R. on the Utilization of Atomic Energy, Moscow, 1960. 276p.

Descriptions are given of main lithium minerals, geochemical and physicochemical properties of lithium and its compounds, the technology of lithium recovery from ores, as well as the metallurgy and analytical chemistry of lithium. References are given to articles and books published from 1818 to 1958. (P.C.H.)

30374 (AEC-tr-5321) MULTIPLE SPLITTING OF THE GROUND LEVEL OF THE HOLMIUM ATOM. V. B. Belyanin. Translated for Ames Lab., Ames, Iowa from Optics and Spectroscopy (U.S.S.R.) (English Translation), 5: 236-7(1958). 4p.

With the use of measurements of the hyperfine structure of HoI spectral lines, and with the help of a method of constant differences, an attempt was made to determine the splitting of the ground level of the holmium atom. (M.C.G.)

30375 (AEC-tr-5353) HYDROLYSIS OF URANIUM MONOCARBIDE. G. Baudin, J. Besson, P. Blum, and J. Spitz. Translated by L. M. Ferris (Oak Ridge National Lab., Tenn.) from Compt. rend., 254: 4179-81(June 13, 1962). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 26984.

30376 (CEA-tr-R-1576) DÉTERMINATION DE L'INDICE D'OXYDATION DE L'OXYDE D'URANIUM AU MOYEN D'UN EXCÈS DE BICHROMATE DE POTASSIUM. (Determination of the Index of Oxidation of Uranium Oxide by Means of an Excess of Potassium Bichromate). L. Neumann. Translated into French from Collection Czechoslov. Chem. Communs., 25: 2235-6(1960). 7p.

A method for determining the oxidation index of uranium oxides is described. The method consists of dissolving the oxide by sulfuric acid in the presence of excessive amounts of potassium bichromate, the oxidizing agent. (tr-auth)

30377 (EURAEC-266) PHYSICAL PROPERTIES OF UO_2 CRYSTALS. Quarterly Report No. 1, October 1 – December 31, 1961. (Brussels. Centre d'Étude de l'Énergie Nucléaire). Work Performed under United States – Euratom Joint Research and Development Program. Contract 963-61-10-RDB I.1.15. 23p. Translation of R-2082.

Results of measurements on the density and electrical conductivity of UO_2 crystals are given. The composite float method was used for density measurements. An activation energy of 0.33 ev was found in the temperature between room temperature and 400°C. The measurement was made in vacuum, but it was found that unavoidable changes of the sample take place when heating above 500°C. A satisfactory method for making contacts resisting up to 900°C was developed. (P.C.H.)

30378 (HW-tr-42) NUCLEAR MAGNETIC RESONANCE (N.M.R.) AND THE HYDROGEN BOND. B. Lemanceau, C. Lussan, and N. Souty. Translated by Liz Appleby (Hanford Atomic Products Operation, Richland, Wash.) from J. chim. phys., 59: 148-53(Feb. 1962). 17p.

Association by H bonding is manifested in nuclear magnetic resonance by a displacement of the associated proton line toward the lower fields. It is shown that displacement observed in terbutanol solutions of low concentration in an inert solvent is related to the first association constant of the alcohol and to the characteristic displacement of the proton engaged in the association. Likewise, in the case of solutions of terbutanol in an oxidized or nitrogenous solvent, taking into account the simultaneity of association and complexing, the displacement at infinite dilution is related to the complexing constant and to the characteristic displacement of the proton engaged in this complexing. (auth)

30379 (JPRS-13623) RARE EARTH ELEMENTS. B. I. Kogan. Translated from Priroda, No. 12, 26-34 (1961). 13p.

The history, abundance, development, properties, and applications of the rare earth elements are discussed. Specific applications are indicated for the seventeen rare earth metals and their numerous combinations. (N.W.R.)

30380 (SCL-T-437) LITHIUM METANIOBATE AND METATANTALATE. A. V. Lapitskii (Lapitskiy) and Yu. P. Simanov. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from Zhur. Fiz. Khim., 29: 1201-3(1955). 6p.

Parameters of the hexagonal (rhombohedral) lattices of lithium metaniobate and lithium metatantalate were determined by indications obtained with the power method. Data are tabulated. (P.C.H.)

30381 POTENTIAL CONSTANTS AND THERMODYNAMIC FUNCTIONS OF ISOTOPIC OXIDES OF NITROGEN. G. Nagarajan (Annamalai Univ., Annamalainagar, South India). Bull. soc. chim. Belges, 71: 222-5(Mar.-Apr. 1962). (In English)

By using the observed zero-order frequencies of isotopic oxides of nitrogen, the evaluation of potential constants on the basis of Wilson's group theoretical method and the calculation of molar thermodynamic functions for the temperature range from 200 to 2000°K on the basis of a rigid rotator, harmonic oscillator model were carried out. (auth)

30382 THE INHIBITED AUTOXIDATION OF STYRENE. PART I. THE DEUTERIUM ISOTOPE EFFECT FOR INHIBITION BY 2,6-DI-tert-BUTYL-4-METHYLPHENOL. J. A. Howard and K. U. Ingold (National Research Council, Ottawa). Can. J. Chem., 40: 1851-64 (Sept. 1962). (NRC-6922)

Most previous work on the inhibition of autoxidation by phenols has indicated that the reaction involves abstraction of the phenolic hydrogen. However, the apparent absence of any appreciable deuterium isotope effect made it difficult to believe that abstraction could be rate-controlling. The present work using styrene as the substrate, 2,6-di-tert-butyl-4-methylphenol as the inhibitor, and azo-bis-isobutyronitrile as the initiator has shown that this reaction has an unexpectedly large isotope effect, e.g., ~10.6 at 65°C. Previous failures to detect an isotope effect are attributed to the rapid exchange of deuterium which takes place between deuterated phenols and traces of moisture or other hydroxyl-containing compounds present in the substrate. Rate constants and activation energies for some of the elementary reactions in the inhibited and uninhibited oxidation of styrene were measured. It is suggested that a compound which functions in the same way as a weak phenolic inhibitor is formed in the apparently uninhibited oxidation. (auth)

30383 DIFFRACTION STUDIES OF THE STRUCTURE OF LIQUIDS. R. F. Kruh (Univ. of Arkansas, Fayetteville). Chem. Revs., 62: 319-46(Aug. 1962).

Methods of determining the average spatial distributions of atoms in liquids are described for monoatomic and polyatomic liquids. The experimental radial distribution data are interpreted in terms of mean distribution of interatomic distances for those liquids with no permanent aggregates and in terms of structures of molecules or complex ions in liquids. Diffraction results are presented for liquid elements and polyatomic liquids, such as liquid inert gases, organic compounds, molten salts, solutions, complexes, and glasses. It is concluded that the properties of the liquid state restrict the application of the diffraction techniques to statistical descriptions of liquid structure. (D.L.C.)

30384 THE NORMAL ORTHOPHOSPHATE OF NIOBIUM. I. V. Tananaev and G. B. Seifer (Kurnakov Inst. of General and Inorganic Chemistry, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1314-5(June 1962). (In Russian)

Phosphate derivates of the NbO_2^+ cation were isolated in the form of the salt $(NbO_2)_2HPO_4 \cdot 2.5H_2O$ by crystallization from 2 to 6 N H_2SO_4 solutions containing ammonium or sodium phosphate. Derivates of the NbO_3^{3+} cation were isolated from 10 to 15 N H_2SO_4, but no salt of the Nb^{5+} cation was isolated. In order to obtain the normal phosphate, freshly-precipitated $Nb_2O_5 \cdot xH_2O$ was reacted with an excess of liquified crystalline H_3PO_4. Chemical analyses on the resulting precipitate showed that the normal phosphate $Nb_3(PO_4)_5$ was isolated. X-ray analyses showed that this was a new compound. Its refractive index is 1.751. A test with NaF, which displaces the hydroxyl group in zirconyl ion, was negative, and was further proof of isolation of the normal phosphate. Tests with $AgNO_3$, $Zn(C_2H_3O_2)_2$, ammonium molybdate and $Al(NO_3)_3$ showed that the sample contained phosphorous only in the form of PO_4^{3-}. Infrared spectrophotometric analysis showed the presence of phosphate and the absence of the niobyl ion, $P_2O_7^{4-}$ and $P_3O_{10}^{5-}$. The density of the normal phosphate $Nb_3(PO_4)_5$ is 2.83 g/cm³ as determined in toluene at 20°C. It is diamagnetic and has a specific electrical resistance of 2.4×10^7 ohm-cm at 20°C. It is insoluble in water, HNO_3, HCl, H_2SO_4, and NH_4OH, but does dissolve on heating in hydrofluoric acid and alkali solutions. An attempt is being made to obtain analogous derivatives of tantalum and vanadium. (TTT)

30385 THE RECIPROCAL EFFECT OF AN ATOM OR A GROUP IN RUTHENIUM NITROSOCOMPLEXES. N. M. Sinitsyn and O. E. Zvyagintsev (Kurnakov Inst. of General and Inorganic Chemistry, USSR). Doklady Akad. Nauk S.S.S.R., 145: 109-11(July 1, 1962). (In Russian)

The presence of a nitroso group in a ruthenium compound should result in a redistribution of electron density over the entire molecule, especially with respect to the group which is in a trans position to the nitroso group. Thus, on heating the nitroso pentamine $[RuNO(NH_3)_5]Cl_3 \cdot H_2O$, the water of crystallization is given off at 115 to 135°C; one molecule of NH_3 is given off at 210 to 240°C; further evolution of ammonia occurs at 270°C, and the nitroso group is evolved at 395 to 410°C with a complete breakdown of the complex. The change in electronic structure of the nitroso group as determined by the change in frequency of the valence oscillations in the infra-red absorption spectrum was followed as a function of the ligand in the position trans to the NO group. In going from OH to NH_3 there is an increase in the binding strength of ruthenium with the NO group as follows: OH > I > Br > Cl > CN, NH_3. The groups in the cis positions also affect the strength of the Ru–No bond. Thus, in the trans compound $(NH_4)_2(RuNOCl_4OH)$, where the Cl groups are in cis positions with respect to the NO group, the distance of the Ru–N bond $r_{RuN} = 2.04$ Å, and in the trans compound $K_2[RuNO(NO_2)_4OH]$, where the NO_2 groups are in a cis position to the NO group, the distance $r_{RuN} = 1.80$ Å. The electronic structure of the nitroso group is characteristic for each individual ruthenium compound, and varies as a function of the electrodonor properties of the ligand and of the cation in the compound. (TTT)

30386 THE DETERMINATION OF THE SATURATION VAPOR PRESSURE OF NIOBIUM DIOXIDE. S. A. Shchukarev, G. A. Semenov, and K. E. Frantseva (Leningrad Univ.). Doklady Akad. Nauk S.S.S.R., 145: 119-21(July 1, 1962). (In Russian)

The vapor pressure of NbO_2 was measured in Knudsen effusion chamber made of forged molybdenum. The diameter of the opening was 0.308 mm, and the ratio of the evaporating area to the area of the opening was 500 : 1. A rhenium–tungsten thermocouple was used to measure the temperature. The chamber was heated by electron bombardment. Niobium pentoxide tagged with Nb^{95} was reduced to NbO_2 by hydrogen at a temperature of 1000°C. The vapor pressure of NbO_2 can be represented by the following equation: $\lg P = (-30{,}300/T) + 12.42$ mm. The heat of sublimation was found to be 138 ± 2 kcal/mol. The standard heat of sublimation is $\Delta H_0 = 141 \pm 0.4$ kcal/mol. The energy for the dissociation of gaseous NbO_2 was calculated to be 14.9 ± 0.1 ev. (TTT)

30387 AN ELECTRON PARAMAGNETIC RESONANCE INVESTIGATION OF THE FREE RADICALS FORMED BY IRRADIATION OF PALMITIC ACIDS AND ITS DERIVATIVES. A. A. Revina, Sh. A. Aripdzhanov, and N. A. Bakh (Inst. of Electrochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk, S.S.S.R., 145: 363-5(July 11, 1962). (In Russian)

Samples of palmitic acid $C_{14}H_{31}COOH$, potassium palmitate, and the triglyceride of palmitic acid $(C_{15}H_{31}COO)_3C_3H_5$ were irradiated at –196°C with Co^{60} γ rays at a dose rate of $\sim 5 \times 10^{16}$ ev/g-sec as determined by ferrous sulfate dosimetry. Electron paramagnetic resonance (EPR) spectra, taken at –196°C after irradiation, showed the presence of different radicals in the samples. A doublet with a splitting of 28 to 30 oersteds, which is characteristic of all irradiated carboxylic acids, was observed in the palmitic acid sample. The radical yields (in radicals per 100 ev) were found to be 20 for irradiation in vacuum and 20 for irradiation in air in the case of palmitic acid, 12 and 7 respectively for the tripalmitate, and 9 and 7 respectively for potassium palmitate. Irradiation in oxygen leads to a decrease in radical yields for the salt and ether, and has no effect on the radical yield of the acid. No radicals of the peroxy type could be detected in the EPR spectra at –196°C. The concentration of radicals in palmitic acid is $\sim 3 \times 10^{21}$ ev/g, and has still not attained a state of stationary equilibrium at this relatively high dose. (TTT)

30388 THE DIFFUSION COEFFICIENT OF LEAD IN MOLTEN CHLORIDES. Yu. M. Ryabukhin and E. A. Ukshe (Bereznikovskii Affiliate of the All-Union, Aluminum-Magnesium Research Inst., USSR). Doklady Akad. Nauk, S.S.S.R., 145: 366-8(July 11, 1962). (In Russian)

A chronopotentiometric method was used to measure the diffusion of $PbCl_2$ (0.1 to 0.2 mole %) in NaCl, KCl, and a mixture of NaCl and KCl. A rectangular polished plate of platinum with an area of about 1 cm² served as the cathode. Fused lead in a quartz tube connected with the melt by a capillary served as an anode and comparison electrode. All

measurements were carried out in an atmosphere of argon. A plot of 1/T versus lg Δ (the diffusion coefficient) gave a straight line, and showed that the following relationship was valid: $\Delta - \Delta_0 \exp(-W/RT)$. The activation energies for the diffusion of lead ions in KCl, NaCl, and NaCl–KCl mixtures were calculated to be 2120, 1670, and 1410 cal/mole respectively. Complexing of lead was noted in the KCl–NaCl mixtures, and especially in pure KCl. It is assumed that the apparent diffusion coefficient at high current densities is related to the actual diffusion coefficient as follows: $\Delta_{act.} = \Delta[1 + (1/K)]^2$. Here K is the dissociation constant of the complex. The values for the dissociation constants of the lead complex in a $PbCl_2$–KCl mixture were calculated to be 10.0 at 965°, 0.1 at 942°, 8.3 at 914°, 6.2 at 863°, 5.5 at 833°, and 5.6 at 811°K. These values of the dissociation constants are close to values quoted in the literature for the lead chloride complex in fused nitrate salts. (TTT)

30389 THE RELATIVE ADSORBABILITY OF TRANSITION ELEMENTS OF THE FOURTH GROUP BY MINERAL CATION EXCHANGERS. D. I. Ryabchikov, I. K. Tsitovich, and M. K. Torpudzhiyan (Kubanskii Agricultural Inst., USSR). Doklady Akad. Nauk S.S.S.R., 145: 825-8(Aug. 1962). (In Russian)

The sorption of Cr(III), Fe(III), Mn(II), Fe(II), Co(II), Ni(II), Cu(II), and Zn(II) from ~0.3 N sulfate was followed on the mineral exchangers $Zr(HPO_4)_2$, $CaHPO_4$, $BaHPO_4$, CaS, $Zr(OH)_4$, $Ti(OH)_4$, ZrO_2, TiO_2, Nb_2O_5, Bi_2O_3, and SnO. The exchange capacity of the mineral exchange was compared with that of chromatographic-grade aluminum oxide. The break-through of the cation was detected by a sensitive spot test [ferricyanide test for Fe(II), benzidine test for Cr(III), dimethylglyoxime test for Ni(II), etc.]. It was found that $Ti(OH)_4$ had the highest exchange capacity. The inorganic exchangers $Ti(OH)_4$, $Zr(OH)_4$, $Zr(HPO_4)_2$, and $CaHPO_4$ had exchange capacities much higher than that of aluminum oxide. The $CaHPO_4$ exchanger showed a high selectivity for Cu(II). The CdS exchanger adsorbs only Cu(II). The $BaHPO_4$ exchanger showed a high selectivity for Fe(III). (TTT)

30390 LAWS OF COPRECIPITATION IN THE FORMATION OF ANOMALOUS MIXED CRYSTALS. D. N. Bukhovskii. Doklady Akad. Nauk S.S.S.R., 145: 845-8(1962). (In Russian)

The cocrystallization of a micro amount of an element by an isomorphous carrier can be described by a linear relation where $D = [x/(a - x)]/[y/(b - y)]$ or by a log relation where $\lambda = [\lg a/(a - x)]/[\lg b/(b - y)]$. Here D and λ are constant distribution coefficients, a and b are the initial concentrations in solution, and x and y are the amounts of micro and macro components in the precipitate. When Ce(III) is coprecipitated by K_2SO_4 or Ce(III) is coprecipitated by $U(C_2O_4)_2$, anomalous mixed crystals can be formed, and three different mechanisms can be visualized for the distribution of components. The components occupy analogous positions in the lattice, and compete with each other (as in the coprecipitation of radium by barium sulfate). The Doerner-Hoskins log distribution coefficient $= \lambda$ is obtained in this case. A second mechanism assumes that the tendency for the micro component to enter the crystal lattice does not depend on the concentration of the macrocomponent. The differential equation describing this behavior is $(dx/dy) = Ka$, and the final equation is $\lg [a/(a - x)] = K y V_{liq.}$. Here K is the distribution coefficient at constant ionic strength in the solution, and $V_{liq.}$ is the volume of liquid. $V_{liq.}$ is expressed in units of mass of precipitate per unit volume of solution. In coprecipitating calcium oxalate with uranium oxalate from 1.0 N HCl and 0.10 M $H_2C_2O_4$, the value of K remained constant at K = 3.1 mg/ml. Coprecipitation of Ce(III) and of thorium (UX_1) with uranium oxalate under these same conditions follows a logarithmic distribution. The third mechanism assumes that the tendency for the microcomponent to precipitate depends linearly on the concentration of the macrocomponent. Here $dx/dy = K'aa'$, and finally $\lg [a/(a - x)] = (K'y/V^2_{liq.})(b - \frac{y}{2})$. The different mechanisms can be evaluated by varying the amount of carrier precipitated over wide limits. (TTT)

30391 NIOBIUM PEROXIDE COMPOUNDS. N. K. Grigor'eva, K. I. Selezneva, and V. M. Duganeva (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, No. 6, 937-43(June 1962). (In Russian)

Niobium peroxide compounds $Na(K)NbO_4 \cdot nH_2O$ are formed by sodium and potassium metaniobate reactions with low-concentration H_2O_2 at 0°C. More soluble peroxide compounds of the perhydrate type $Na(K)NbO_4 \cdot nH_2O_2 \cdot mH_2O$ (n = 1.3 to 1.5; m = 1.5 to 3), unstable at 0°, are formed with higher H_2O_2 (10 to 54%) concentrations. Permetaniobate perhydrates prepared at –10° are more stable and have a higher content (11 to 12.3%) of active oxygen. (R.V.J.)

30392 ISOTOPIC EXCHANGE OF HYDROGEN IN HYDROCARBONS ON THE RARE-EARTH OXIDES. I. DEUTERIUM EXCHANGE REACTION ON NEODYMIUM OXIDE BETWEEN CYCLOHEXANE AND DEUTERIUM. Kh. M. Minachev, E. G. Vakk, and R. V. Dmitriev (Zelinskii Inst. of Organic Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, No. 6, 1086-93(June 1962). (In Russian)

Isotopic exchange of hydrogen between cyclohexane and gaseous deuterium was investigated. The exchange was carried out on neodymium oxide at atmospheric pressure and 157 to 553°C. Deuterium exchange began at 400 to 512°; the total yield of $C_6H_{12-x}D_x$ was over 41%. The distribution of deuterium in cyclohexanes, investigated by mass spectrometer, showed that about 98.5% of the deuterium is in D_1, D_2, and D_3 cyclohexane and 0.8% is in other deuterocyclohexanes. (R.V.J.)

30393 USE OF RADIOACTIVE ISOTOPES FOR THE STUDY OF THE VAPORIZATION OF SALTS IN AN ALTERNATING-CURRENT ARC. M. M. Pavlyuchenko and B. O. Filonov. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 26: 878-81 (July 1962). (In Russian)

In order to evaluate the influence of the NaCl and KCl content of minerals on the intensity of the spectral lines, artificial mixtures were prepared containing various NaCl/KCl ratios. It was found that the intensity of the Li, Rb, Ba, and Cd lines, obtained by vaporizing the powdered material in a C electrode in an 8-amp a-c arc varied with the composition of the material: if only NaCl or only KCl was present, the maximum intensity was observed during the initial heating period while in the case of a mixture, the maximum shifted in time toward the end of the vaporization. Further studies were made by using radioactive $Cd^{115}Cl_2$. In view of the higher vapor pressure of KCl, it was expected that it will be vaporized first, this was not the case in the experiments. The vapor pressure of $CdCl_2$ was determined at 895, 1011, and 1086°C by means of the Cd^{115} activity in the condensate. Extrapolation of the results showed that already at 1300° the vapor pressure of $CdCl_2$ over KCl is higher than over NaCl + KCl mixtures. Thus the dependence of the rate of vaporization of the elements on the composition of the sample is a function of the pressure of the vapor over the molten salt mixture. (TTT)

30394 NEW DEUTERIUM LAMPS. S. I. Levikov and L. P. Shishatskaya. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 26: 964-6(July 1962). (In Russian)

In order to determine the differences in the radiation of hydrogen and deuterium, 3 lines of the Balmer series, a continuous and a band spectrum of the 2 materials were compared with each other, under identical conditions. The newly developed D lamps were provided with windows made of ultraviolet transmitting glass or of LiF. The ratios of the 3 lines of the Balmer series of H and D were 1.29 for the red line, 1.11 for the blue line, and 1.37 for the violet line. In the continuous spectrum from 2500 to 1450Å the D radiation was more effective; this effect was more marked toward the shorter wavelengths. In the shortwave region from 2500 to 1450Å the radiation of D was again found to be more effective but at 1710Å this prominence of the heavy isotope disappears. Thus, it is recommended that lamps to be used at wavelengths longer than 1700Å should be filled with D instead of H. (TTT)

30395 PAPER-ELECTROPHORETIC STUDIES OF THE SOLUTION CHEMISTRY OF RaD(^{210}Pb), RaE(^{210}Bi) AND RaF(^{210}Po). I. IN HYDROCHLORIC ACID. S. K. Shukla and J. P. Adloff (Centre de Recherches Nucleaires, Strasbourg). J. Chromatog, 8: 501-6(Aug. 1962). (In English)

The paper electrophoretic mobilities of RaD, RaE, and RaF were measured with hydrochloric acid as the background electrolyte in the concentration range 0.0025 to 8 N. The isoelectric concentration, where the change from cationic to anionic movement takes place, was determined for the three elements; this was found to be the lowest for RaF and the highest for RaD. This is in agreement with the tendency of these elements to form complexes and also with the number of the positive charge carried by the ions. The concentration ranges in which RaD, RaE, and RaF exist as cation and as anion were investigated. An attempt was made to define the concentration range of HCl in which excellent separations of these elements can be obtained by paper electrophoresis. (auth)

30396 THE ANION EXCHANGE BEHAVIOUR OF URANIUM AND THORIUM IN SULPHURIC ACID SOLUTIONS CONTAINING ALIPHATIC ALCOHOLS. G. E. Janauer and J. Korkisch (Univ. of Vienna). J. Chromatog., 8: 510-15 (Aug. 1962). (In English)

The anion exchange behavior of uranium and thorium in sulfuric acid–alcohol media was investigated employing the strongly basic anion exchanger Dowex I X8. Extremely high distribution coefficients for uranium were found, for which a theoretical explanation is offered. (auth)

30397 ON THE PAPER "THE ABSORPTION SPECTRA OF NEODYMIUM CHLORIDE IN ALCOHOL-WATER SOLUTIONS AT LOW TEMPERATURES." A. N. Zaidel. Optics and Spectroscopy, 12: 456(June 1962).

The formation of solvates between the Nd ions and the alcohol and water atoms, as evidenced by the changes in the Nd ion spectra as the alcohol-water ratio is varied, is discussed for –80°C and room temperature. (T.F.H.)

30398 A STUDY OF THE STRUCTURE OF EVAPORATED LITHIUM FLUORIDE. D. S. Campbell, D. J. Stirland, and H. Blackburn (Plessey Co., Ltd., Towcester, Northants, Eng.). Phil. Mag. (8), 7: 1099-1116(July 1962).

The initial stages of growth of evaporated lithium fluoride films deposited on carbon were studied. It was shown that lithium fluoride deposits as discrete crystalline islands. The size of the islands is dependent on the rate of deposition; fast rates produce more and smaller islands than slow rates. As the film thickness increases, the islands are shown to reach a maximum area in the plane of the substrate, and then break up to give a greater number of smaller islands. Evidence is given to show that the initial nuclei of lithium fluoride are cubes of approximately 70 Å side. A theoretical growth model was constructed on this basis and is shown to agree with experimental facts. There is considerable evidence that, in the initial stages of growth, the lithium fluoride islands are mobile on the substrates. Comparable measurements were made on gold deposited on carbon substrates. (auth)

30399 OPTICAL SPECTRA AND PARAMAGNETIC RESONANCE OF U^{4+} IONS IN ALKALINE EARTH FLUORIDE LATTICES. R. S. Title, P. P. Sorokin, M. J. Stevenson, G. D. Pettit, J. E. Scardefield, and J. R. Lankard (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 128: 62-6(Oct. 1, 1962).

Paramagnetic resonance absorption measurements of uranium in various symmetries in CaF_2 and SrF_2 crystals are given. It is concluded that the centers seen in trigonal symmetry are U^{4+} ions. This conclusion is based on the observed direct correlation between the trigonal center resonance and one of two components which, generally speaking, together constitute the optical absorption spectra of these crystals. This spectral component is isolated and shown to agree with the published optical absorption spectra of U^{4+} compounds. Also, it is shown that the observed asymmetry of the trigonal center resonance and its zero $g_\perp$ value characterize the ground state (f^2,H_4^1), in trigonal symmetry and cannot be properties of the state (f^2,I_4^1). A model is proposed for the U^{4+} center. (auth)

30400 FLAME SPECTRA OF THE RARE-EARTH ELEMENTS. V. A. Fassel, R. H. Curry, and R. N. Kniseley (Ames Lab., Ames, Iowa). Spectrochim. Acta, 18: 1127-53(Sept. 1962). (IS-387)

The rare earth elements, including scandium and yttrium, emit intense line spectra when absolute ethanol solutions of rare-earth halide or perchlorate salts are aspirated into fuel-rich, oxy-acetylene flames. Recordings of the spectra are given, along with the exact wavelengths of about 1200 of the strongest lines. A discussion of the analytical utility of the stronger lines and excitation processes which may account for the appearance of the spectra is included. (auth)

30401 RAMAN SPECTRA OF ELECTROLYTE SOLUTIONS IN LIGHT AND HEAVY WATER. R. E. Weston, Jr. (Centre d'Etudes Nucleaires, Saclay, France). Spectrochim. Acta, 18: 1257-77(Sept. 1962).

The Raman spectra of light water, heavy water, and mixtures of the two were obtained, and vibrational frequency assignments were made for H_2O, HDO, and D_2O. Changes in frequency, intensity, and band width of the solvent bands were determined for KF, KCl, KBr, KI, and LiBr dissolved in H_2O–HDO mixtures at concentrations up to 6 M. All of the salts except KF increased the stretching frequencies, while the bending frequency remained practically unchanged. The shape of the O—H stretching band was changed and the intensity was slightly increased by added salts, while the intensity of the bending band increased by as much as an order of magnitude. Band widths of both bands were generally decreased by dissolved salts. The effects increased monotonically with increasing concentration, and the influence of different anions was in the order $F^- < Cl^- < Br^- < I^-$, with the fluoride ion generally having an effect opposite to that of the others. No difference was found between the effects of LiBr and KBr. Changes in the spec-

trum similar to those found in salt solutions were noted when the temperature of the pure solvent was raised from 12 to 82°C. The change in shape of the O—H stretching band can be attributed to a Fermi resonance between ν_1 and $2\nu_2$. Other changes in the spectra are attributed to a combination of electrostatic interaction between ions and solvent dipoles and a decrease in hydrogen-bonding of the solvent. (auth)

30402 CHLORINATION PROCESS FOR NIOBIUM CONCENTRATES. A. S. Berngard, I. E. Vil'komirskii, V. A. Kozhemyakin, T. S. Sedykh, and O. I. Erokhina. Tsvetnye Metally, 35: No. 4, 56-61(1962). (In Russian)

An improved chlorination method using "dry" fractional condensation of sublimed chlorides is suggested for niobium concentrates containing 36.2 to 36.5% TiO_2, 8.45 to 8.55% Nb_2O_5, 0.55 to 0.57% Ta_2O_5, 28.64 to 31.18% rare earths, 1.57 to 3.04% Fe_2O_3, 0.87 to 4.76% Al_2O_3, 2.5 to 5.87% SiO_2, 9.86% $NaO + K_2O$, 5.94 to 7.92% CaO, or 0.15% P. The scheme and operation of the installation is described. The method eliminated the complicated equipment for pulp separation, reduced the content of carbon in coke from 18 to 20% to 12 to 13%, reduced the consumption of oil coke about 30%, and increased the working capacity of the furnace 6%. (R.V.J.)

30403 CALCULATION OF THE THERMODYNAMIC CHARACTERISTICS OF THE HYDRATION OF IONS INCAPABLE OF PROLONGED EXISTENCE IN AQUEOUS SOLUTION. S. I. Drakin and V. A. Mikhailov (Moscow Mendeleev Inst. of Chemical Technology and Inst. of Inorganic Chemistry, Siberian Dept. of the Academy of Sciences). Zhur. Fiz. Khim., 36: 1698-1704(Aug. 1962). (In Russian)

A formula is proposed for calculating the radii of ions of intermediate oxidation states. Based on a consideration of the state of the water molecules near the ion, it is suggested that the term $\partial A_n/\partial T$ for the entropy of formation of the cavity containing the ion may be neglected. A cycle is proposed for calculating the hydration energy of anions. The entropy of hydration is obtained by differentiating with respect to temperature. The results of the calculations are compared with experimental data. Deviations observed in some cases are discussed. The method was used for calculating the energy, entropy, and heat of hydration of 47 unstable ions. (auth)

30404 TAUTOMERISM IN HETEROCYCLIC DERIVATIVES. XIII. SPECTRA AND STRUCTURES OF HETEROCYCLIC AMINES. Yu. N. Sheinker and E. M. Peresleni (All Union Scientific Research Chemical-Pharmaceutical Inst., USSR). Zhur. Fiz. Khim., 36: 1705-12(Aug. 1962). (In Russian)

A comparison of the infrared spectra of deuterated and nondeuterated heterocyclic amines showed that N-heteroaromatic amines exist in the amino and not imino forms. This holds also for 9-aminoacridine, which in a number of investigations was regarded as 9-acridoimine. The amino form is primarily due to the advantage from an energy standpoint of the amino structure for the aromatic system of bonds of the heterocycle. However, the amino structure also holds for heterocyclic amines with partially saturated heterocycle and an amidine bond system. This is shown for 2-aminothiazoline. (auth)

30405 CONTRIBUTION TO THE STATISTICAL THERMODYNAMIC CALCULATION OF ADSORPTION EQUILIBRIUM IN THE SYSTEM ARGON–GRAPHITE. D. P. Poshkus and A. V. Kiselev (Inst. of Chemistry and Chemical Technology, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 1735-42(Aug. 1962). (In Russian)

In order to correlate the potential energy of an adsorbed atom and its position from the basal plane of graphite a satisfactory approximation is to use the mean values of the power sums Σr^{-6} and Σr^{-8} for equal values of z, and the mean slopes of the curves depicting the dependence between z and the exponential sums $\Sigma e^{-r/0.35}$ where r and z are the distances of the center of the adsorbed atom from the centers of the various carbon atoms and from the exterior basal plane passing through the centers of the carbon atoms of the graphite lattice. In the calculation the states of vibration of the adsorbed atom of argon perpendicular to the basal plane of graphite may be, to a good approximation, considered to be harmonic. The deviation between the theoretical and experimental values for the change in chemical potential in the adsorption of argon on the basal plane of graphite lies within the error of calculation. The deviation may be due largely to the uncertainty of the value for z_0 over the center of the hexagon of carbon atoms of the graphite lattice. (auth)

30406 KINETIC ISOTOPIC EFFECT OF SECONDARY TRITIUM ATOMS IN THE MOLECULE OF n-HEPTANE-t IN THE LIQUID PHASE REACTION WITH FREE RADICALS AND THE REACTIVITY OF THE BOND. I. V. Berezin and N. F. Kazanskaya (Moscow State Univ.). Zhur. Fiz. Khim., 36: 1800-2(Aug. 1962). (In Russian)

The relative constant of 4c—T bond stripping in n-heptane by free methyl radicals was determined at various temperatures. The isotopic effect of the secondary n-heptane hydrogen atoms in reaction with methyl radicals is identical to the total isotopic effect. (R.V.J.)

30407 SYNTHESIS OF ZrI_4 AND HfI_4 BY HALOID EXCHANGE. L. A. Nisel'son, M. V. Teslitskaya, and T. A. Shvedova. Zhur. Neorg. Khim., 7: 971-4(May 1962). (In Russian)

Syntheses of ZrI_4 and HfI_4 by reactions of $ZrCl_4$ with SiI_4, Al_2I_6, HI, and Al_2Br and $HfCl_4$ with Al_2I_6 are analyzed. The highest exchange yield was reached with $Zr(Hf)Cl_4$ reaction with Al_2I_6. The separation of ZrI_4 from $ZrCl_4$ and other admixtures was achieved by distillation. (R.V.J.)

30408 PREPARATION AND PHYSICO-CHEMICAL PROPERTIES OF YTTRIUM CARBIDES. G. V. Samsonov, T. Ya. Kosolapova, and G. N. Makarenko (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Zhur. Neorg. Khim., 7: 975-9(May 1962). (In Russian)

The chemical and physical properties of YC, Y_2C_3, and YC_2 were studied, and the temperature effects in the preparation of these carbides were analyzed. It was found that YC is formed at 1800 to 1900°C, Y_2C_3 at 1700 to 1800°C, and YC_2 at 1900°C. (R.V.J.)

30409 SOLUBILITY OF THE BASIC URANIUM(IV) SULFURIC SALT. M. A. Stepanov and N. P. Salken. Zhur. Neorg. Khim., 7: 983-6(May 1962). (In Russian)

The basic composition of U(IV) sulfuric salts, $U(OH)_2SO_4$, was determined by pH graph. The solubility of the compound is $(6.75 \pm 0.54) \times 10^{-32}$. (R.V.J.)

30410 REACTIONS OF URANYL NITRATE SOLUTIONS WITH ALKALI METAL CARBONATES. V. I. Paramonova, B. P. Nikol'skii, and N. M. Nikolaeva (Leningrad State Univ.). Zhur. Neorg. Khim., 7: 1028-35(May 1962). (In Russian)

Carbonate complexing and hydrolysis processes were found in uranyl nitrate reactions with sodium carbonates or bicarbonates. The hydrolysis reaction is identical to uranyl nitrate reactions with alkali solutions. Precipitates in UO_2^{2+} hydrolysis have identical compositions. In solutions with $\varphi \approx 4$, U(VI) appears as a stable bicarbonate

complex, and in solutions with $\varphi > 6$ a stable tricarbonate complex is formed. (R.V.J.)

30411 COMPLEX FORMATION OF ZIRCONIUM(IV) AND HAFNIUM(IV) WITH CHLORIDE, NITRATE AND OXALATE IONS. I. N. Marov and D. I. Ryabchikov. Zhur. Neorg. Khim., 7: 1036-48(May 1962). (In Russian)

An analysis of Zr and Hf sorption by KU-2 cation resin from mixed 2.0 to 4.0 mole/l hydrochloric solutions ($HClO_4$ + HCl and $HClO_4$ + HNO_3) showed that at $\mu = 2.0$ zirconium and hafnium formed identical complexes ($MeCl^{3+}$, $MeCl_2^{2+}$, $MeCl_3^{+}$, and $MeCl_4^{0}$) with stability constants $\beta_1 = 0.95 \pm 0.05$, $\beta_2 = 0.12 \pm 0.05$, $\beta_3 = 0.070 \pm 0.01$, and $\beta_4 = 0.080 \pm 0.005$. The sorption of Zr and Hf by KU-2 from perchloric acid with $\mu = 2.0$ and 4.0 mole/l was also studied in the presence of oxalic acid. (R.V.J.)

30412 COMPLEX COMPOUNDS FORMED BY RARE EARTHS WITH NITRILOTRIACETIC ACID IN ION EXCHANGE CHROMATOGRAPHY. N. D. Mitrofanova and L. I. Martynenko (Moscow State Univ.). Zhur. Neorg. Khim., 7: 1049-53(May 1962). (In Russian)

Preparation of complex Nd compound, with nitrilotriacetic acid (monocomplex NdX and dicomplex $(NdX_2)^{3-}$) was studied. A method is suggested for determining noncomplexed nitrilotriacetic acid in eluate in the presence of rare earth elements. It was found that elution of Nd by NTA forms only the monocomplex. It is also shown that NdX adsorption takes place on the resin during Nd elution. (R.V.J.)

30413 SYNTHESIS AND PROPERTIES OF SODIUM ZIRCONATES AND HAFNATES. A. A. Grizik and V. E. Plyushchev (Moscow State Univ.). Zhur. Neorg. Khim., 7: 1054-61(May 1962). (In Russian)

Reactions of Na_2CO_3 and ZrO_2 were investigated at various temperatures, and the formation and crystallization of $Na_2O - ZrO_2$ compounds (Na_2ZrO_3) were analyzed. Preparations of relatively large crystals of pure sodium metazirconates and metahafnates are described. Intraplane distances, crystal lattices, and pycnometric densities were determined. Hydrolysis of sodium metazirconate and metahafnate and their thermal stabilities were determined. (R.V.J.)

30414 SOLUBILITY AND THERMAL STABILITY OF $ZrO(NO_3)_2.6H_2O$ AND $HfO(NO_3)_2.6H_2O$. L. I. Yuranova, L. I. Komissarova, and V. E. Plyushchev (Moscow State Univ.). Zhur. Neorg. Khim., 7: 1062-7(May 1962). (In Russian)

Solubilities of $ZrO(NO_3)_2 \cdot 6H_2O$ and $HfO(NO_3)_2 \cdot 6H_2O$ in water at 0 to 80°C were analyzed, and dehydration and decomposition processes were studied. It was determined that $ZrO(NO_3)_2 \cdot 6H_2O$ and $HfO(NO_3)_2 \cdot 6H_2O$ are thermally unstable and completely desintegrate at 400°C. The decomposition by stages is more clearly evident in $HfO(NO_3)_2 \cdot 6H_2O$. (R.V.J.)

30415 INVESTIGATIONS OF CADMIUM PYROPHOSPHATE COMPLEXES. M. S. Novakovskii and M. G. Mushkina. Zhur. Neorg. Khim., 7: 1068-73(May 1962). (In Russian)

Complex formation in cadmium nitrate-sodium pyrophosphate at pH 9.3 to 9.8 was studied using the electromotive force method. The simultaneous appearance of two complexes, $Cd(P_3O_7)_2^{4-}$ and $CdOH(P_3O_7)_2^{5-}$, having identical stability constants $(1.37 \pm 0.01) \times 10^{-6}$ was observed. The stability value is in good agreement with data obtained with variable pH. (R.V.J.)

30416 EVALUATION OF COMPLEX COMPOUND STABILITY BY ION EXCHANGE CHROMATOGRAPHY M. M. Senyavin and L. I. Tikhonova. Zhur. Neorg. Khim., 7: 1095-1100(May 1962). (In Russian)

The composition and stability constants for Sr^{2+} complexes with 1,2-diaminocyclopentanetetraacetic acid at pH 7.5 and Y^{3+} with diethylenetriaminopentaacetic acid and NNN'N'-tetraacetic acid-2,2'-ether at 3.0 and 3.5 pH were determined with KU-2 cation resin. The instability constants are $(5.2 \pm 0.1) \times 10^{-23}$ and $(1.2 \pm 0.1) \times 10^{-18}$, respectively. The results are in good agreement with published data. (R.V.J.)

30417 INVESTIGATIONS OF $ZrO_2-HCl-H_2O$ BY SOLUBILITY AND SPECTROPHOTOMETRIC METHODS. Ya. G. Goroshchenko and T. P. Spasibenko. Zhur. Neorg. Khim., 7: 1159-68(May 1962). (In Russian)

An analysis was made of $ZrO_2-HCl-H_2O$ solubility at 0 to 75°C. The existence of equilibrium solid solutions, $ZrOCl_2 \cdot 8H_2O$ and $ZrOCl \cdot 3H_2O$, was found. The solubility diagram and absorption spectra indicate two types of zirconium systems: one with >10% HCl containing ZrO(OH)Cl and $Zr_2O_3(OH)Cl$, and the other with <10% HCl containing nondissociated $ZrOCl_2$ and zirconyl ions. (R.V.J.)

30418 CO-PRECIPITATION OF Ge WITH HYDROXIDES OF TRIVALENT METALS. I. V. Tananaev and M. Ya. Shpirt. Zhur. Neorg. Khim., 7: 1174-81(May 1962). (In Russian)

Coprecipitation of Ge(GeO_2 solution) with Al, Y, and La hydroxides was studied. Solid solutions of Al and La germanates, $1.5\ Al_2O_3 \cdot GeO_2 \cdot nH_2O$ and $2La_2O_3 \cdot GeO_2 \cdot mH_2O$, were separated at $Me_2O_3 : GeO_2$ ratios of 30 to 1.5 and at 8 to 2, respectively. With increased amounts of Ge the germanates form compounds with $GeO_2 : Me_2O_3 = 2$. Iron and yttrium germanates form continuous solid solutions with hydroxides of the respective metals. (auth)

30419 PRECIPITATION IN THE $Tl^+, N^+ \,||\, Ru^{3+}, S^{2-}$ SYSTEM. N. A. Rudnev and G. I. Malofeeva. Zhur. Neorg. Khim., 7: 1182-6(May 1962). (In Russian)

Coprecipitation of Tl with Ru_2S_3 formed a chemical compound, $TlRu_2S_3$, with Tl : Ru = 1 : 2. The $TlRu_2S_3$ solubility for thallium is 3.4×10^{-3} mole/l. (R.V.J.)

30420 STUDIES OF ZIRCONIUM STATE IN SOLID SOLUTIONS BY MEANS OF ION EXCHANGE ADSORPTION. B. I. Nabivanets. Zhur. Neorg. Khim., 7: 1187-90(May 1962). (In Russian)

Adsorption of Zr from hydrochloric solutions by KU-2 cationite was studied by shifting the equilibrium. An increased concentration of Zr and diminished acidity in the medium stimulated the polymerization factor. Monomeric Zr cations dominate at 4N HClO with Zr concentrations of 10^{-4} to 10^{-2} mole/l. The polymerization factor at 0.14N HClO and Zr concentration $\sim 10^{-2}$ mole/l is P = 6 to 7. (R.V.J.)

30421 INSTABILITY CONSTANTS OF COMPLEX ZIRCONIUM FLUORIDES. Yu. A. Buslaev. Zhur. Neorg. Khim., 7: 1204-6(May 1962). (In Russian)

A potentiometric analysis was made for determining the instability of complex fluorozirconium ions. The formation constant is developed as function of log (HF/H^+). It is obvious that the degree of ZrF_4^{4-} disintegration diminishes with increased concentration of zirconium fluoride, introduced directly as $(NH_4)_2ZrF_6$. Assuming that $K_{HF} = 7.2 \times 10^{-4}$, then $K_{ZrF_4} = 1.1 \cdot 10^{-5}$, $K_{ZrF_5^-} = 2.3 \times 10^{-8}$, and $K_{ZrF_6^{2-}} = 1.0 \times 10^{-36}$. (R.V.J.)

30422 DETERMINATION OF MOLECULAR REFRACTION IN URANYL-UREA COMPOUNDS. V. P. Markov and I. V. Tsapkina. Zhur. Neorg. Khim., 7: 1206-7(May 1962). (In Russian)

Molecular refraction, R_D, for a series of urea-uranyl compounds was determined and tabulated. The obtained data are used for determining ion refraction for the $R_DUO_2^{2+}$ group. The $R_DUO_2^{2+}$ refraction is not constant and changes with a certain pattern; with an increased number of urea molecules the $R_DUO_2^{2+}$ decreases. The instability of $R_DUO_2^{2+}$ depends on the number of neutral addends. The formation of new uranium-urea bonds results in a reduced number of uranyl bonds, reducing the magnitude of $R_DUO_2^{2+}$. (R.V.J.)

30423 INVESTIGATION OF $PrCl_3$–Pr SYSTEM. G. I. Novikov and O. G. Polyachenok (Leningrad State Univ.). Zhur. Neorg. Khim., 7: 1209-10(May 1962). (In Russian)

A melt diagram was constructed for $PrCl_3$–Pr, and the vapor pressure-composition isotherm at 1180°C was found. (R.V.J.)

30424 THE ENTHALPY OF FORMATION OF PENTAVALENT AND OXYTRIVALENT NIOBIUM. S. A. Shchukarev, E. K. Smirnova, I. V. Vasil'kova, and N. I. Borovkova. Zhur. Neorg. Khim., 7: 1213-15(June 1962). (In Russian)

A new method of preparing niobium pentabromide is described, and the enthalpies of niobium pentabromide and oxytribromide hydrolysis are determined calorimetrically. The heats of formation of niobium pentabromide and oxytribromide are $\Delta H^0 = -132.2 \pm 1.2$ and -179.3 ± 1.0 kcal/mole, respectively. (R.V.J.)

30425 HYDROLYSIS AND ENTHALPY OF FORMATION OF NIOBIUM OXYTRICHLORIDE. S. A. Shchukarev, E. K. Smirnova, T. S. Shemyakina, and E. N. Ryabov. Zhur. Neorg. Khim., 7: 1216-18(June 1962). (In Russian)

The hydrolysis of niobium oxytrichloride at 350 to 550°C results in Nb_4OCl. The heat of hydrolysis is -35.2 ± 0.5 kcal/mole. The heat of formation of niobium oxytrichloride is $\Delta H^0_{298} = -212.2 \pm 0.9$ kcal/mole. (R.V.J.)

30426 VARIABLE THERMODYNAMIC FUNCTIONS IN HYDRATION OF TRIVALENT LANTHANIDE CATIONS. E. K. Zolotarev and V. E. Kalinina (Lisichansk Branch of the State Inst. of Nitrogen Industry, USSR). Zhur. Neorg. Khim., 7: 1225-7(June 1962). (In Russian)

Approximation methods were used for calculating thermodynamic properties of trivalent lanthanide hydrolysis. The results were in good agreement with experimental data. (R.V.J.)

30427 REACTIONS OF BERYLLIUM ACETATE COMPLEX COMPOUNDS $[Be_4O(CH_3COO)_6 \cdot 3R-NH_2]$ WITH ALCOHOLS. E. G. Pogodilova, A. I. Grigor'ev, and A. V. Novoselova. Zhur. Neorg. Khim., 7: 1285-8(June 1962). (In Russian)

The products of $Be_4O(CH_3COO)_6 \cdot 3R-NH_2$ reactions with methanol and ethanol, when boiled over potassium oxides or over metallic magnesium, were analyzed and tabulated. The general scheme of beryllium oxyacetate in alcohols did not confirm the existence of the hypothetical soluble product $Be(OH)OCOCH_3$. It is surmised that at the beginning of the reaction 4 moles of $Be(OR)OCOCH_3$ and one mole of water form $Be_4O(CH_3COO)_6 + 4ROH = 4Be(OR)OCOCH_3 + 2CH_3COOH + H_2O$. After continuous heating the water partially hydrolyzes beryllium alcohol acetate. (R.V.J.)

30428 COMPOSITION OF ZIRCONIUM AND HAFNIUM CUPFERRONATES. K. F. Karlysheva and I. A. Sheka. Zhur. Neorg. Khim., 7: 1291-8(June 1962). (In Russian)

The composition of Zr and Hf cupferronates prepared at various acidities and aging times was analyzed. Cupferronate reactions with Zr^{4+} or strong complexes of zirconium fluoride, sulfate, or nitrate precipitate into $Zr[C_6H_5N(NO)O]_4$. The influence of nitric acid concentration on zirconium or hafnium cupferronate composition was studied. In weakly acid solutions both Hf and Zr form variable composition cupferronates. (R.V.J.)

30429 SATURATED VAPOR PRESSURE OF TRIVALENT La, Ce, Pr, AND Nd CHLORIDES. G. I. Novikov and A. K. Baev (Leningrad State Univ.). Zhur. Neorg. Khim., 7: 1349-52(June 1962). (In Russian)

Saturated vapor pressures of La, Ce, Pr, and Nd chlorides were measured at 1124 to 1220, 1093 to 1224, 1041 to 1192, and 962 to 1192°C, respectively. The magnitudes of ΔH_{vap} and ΔS^0_{vap} and the boiling points were found. (R.V.J.)

30430 PRESSURE AND COMPOSITION OF SATURATED VAPOR OVER LaCl–KCl SYSTEMS. G. I. Novikov and A. K. Baev (Leningrad State Univ.). Zhur. Neorg. Khim., 7: 1353-9(June 1962). (In Russian)

Measurements were made of vapor pressure over molten LaCl–KCl, CeCl–KCl, PrCl–KCl, and NdCl–KCl systems at 900 to 1200°C. The high content of rare earth chlorides indicates that binary chlorides transform into vapor by partial disintegration. (R.V.J.)

30431 REACTIONS OF PENTAVALENT Nb WITH SODIUM AND POTASSIUM CHLORIDES. A. P. Palkin and N. D. Chikanov (Voronezh State Univ., USSR). Zhur. Neorg. Khim., 7: 1370-6(June 1962). (In Russian)

A constitution diagram was constructed for $NbCl_5$–NaCl–KCl and conductance polytherms were determined. It was found that high-temperature polymorphous modifications of congruent $KNbCl_6$ and incongruent $NaNbCl_6$ form continuous solid solutions. At 318 and 247°C the polymorphous modifications crystallize according to an eutectoid scheme. $KNbCl_6$ with NaCl has the eutectic composition 2% NaCl, 49% NbCl, and 49% KCl at 390°C. In transition from $NbCl_5$–NaCl to NaCl–$KNbCl_6$ and further to $KNbCl_6$–KCl, the peritectic process changes to eutectic as the temperature drops from 444 to 366°C. The surface of the liquidus $NbCl_5$–NaCl–KCl system consists of primary crystallization fields of NaCl, solid solution NaCl–KCl, and α–$KNbCl_6$–α $NaNbCl_6$. The systems close to the $NbCl_5$ peak are low-temperature and those close to the NaCl and KCl peaks are high-melting. Polymorphous transitions $\beta \rightarrow \alpha$-NaNbCl and $\gamma \rightarrow \beta KNbCl_6$ are followed by increased conductivity and high thermal effects. (R.V.J.)

30432 ISOTHERM OF BERYLLIUM SULFATE–UREA–WATER SYSTEM SOLUBILITY, VISCOSITY AND GRAVITY. K. Sulaimankulov. Zhur. Neorg. Khim., 7: 1418-20(June 1962). (In Russian)

The isotherm of solubility, specific gravity, viscosity, and internal friction of $BeSO_4$–$CO(NH_2)_2$–H_2O was studied at 30°C. Two chemical compounds $BeSO_4 \cdot 2CO(NH_2)_2 \cdot H_2O$ and $BeSO_4 \cdot 3CO(NH_2)_2$ were observed and their solubility analyzed. (R.V.J.)

30433 PHYSICO-CHEMICAL ANALYSIS OF COMPLEX-FORMATION IN $BeSO_4$–CH_3CONH_2–H_2O SYSTEM. E. A. Gyunner (Crimean Frunze Teacher Inst., USSR). Zhur. Neorg. Khim., 7: 1431-3(June 1962). (In Russian)

A physico-chemical analysis was made of $BeSO_4$–CH_3CONH_2–H_2O. The density index of refraction, viscosity, and electric conductivity indicates the formation of $[Be(CH_3CONH_2)_2]SO_4$. (R.V.J.)

30434 TEMPERATURE EFFECTS ON SORPTION AND ELUTION OF HYDROLYZED THORIUM IONS. A. I. Zhu-

kov, V. N. Onosov, and M. T. Krasil'nikov. Zhur. Neorg. Khim., 7: 1448-51(June 1962). (In Russian)

Temperature effects on Th sorption from 0.025 M chloride solutions at pH 0.3, 1.62, and 2.73 on H-form resin and elution by 1 N ammonium chlorides were analyzed. (R.V.J.)

30435 SORPTION OF HYDROLYZED I AND II GROUP ELEMENTS BY CATION-EXCHANGE RESINS. A. I. Zhukov, G. P. Baranov, and P. V. Plyasunov (Ural Polytechnic Inst., USSR). Zhur. Neorg. Khim., 7: 1452-7(June 1962). (In Russian)

All first and second group elements (except mercury) were eluted completely from KU-1 and KU-2 resins by ammonium chloride or ammonium nitrate solution and were reduced to metals. The slow elution of Be was due to its sorption as $Be[(OH)_2Be]_n^{2+}$, with n a function of pH. Separation of Th from Sr and Zn on KU-1 resin by 1 N ammonium chlorite is described. (R.V.J.)

30436 SORPTION OF HYDROLYZED IONS OF CERTAIN III AND IV GROUP ELEMENTS BY CATION EXCHANGE RESINS. A. I. Zhukov, V. G. Shakurov, and P. V. Plyasunov (Ural Polytechnic Inst., USSR). Zhur. Neorg. Khim., 7: 1458-63(June 1962). (In Russian)

Sorption of Al, Ti^{4+}, and Pb^{2+} by KU-1 and KU-2 resins and Zr by KU-1 followed by elution by stoichiometrically neutral and acidic 1 N solutions of ammonium chloride and ammonium nitrate was analyzed. Acidification speeds up the elution process. It is shown that at pH above 2, Al is sorbed by KU-1 and KU-2 as polynuclear hydroxide complexes with 3^+ charge; at pH 3.85 the mean number of Al atoms reaches ~5. Separation of Th from Al and Zr from Al and U was achieved with ammonium chloride solutions. (R.V.J.)

30437 ROENTGENOGRAPHIC STUDIES OF $ZrBr_4$. S. S. Berdonosov, A. V. Lapitskii, L. G. Vlasov, and D. G. Berdonosova. Zhur. Neorg. Khim., 7: 1464-6(June 1962). (In Russian)

The x-ray-diffraction analysis of $ZrBr_4$ revealed a cubic structure with $a = 10.95 \pm 0.01$Å, Z = 8, and space group T_h^6-Pa3. The pycnometric specific gravity of $ZrBr_4$ was determined as $d_4^{25} = 3.98 \pm 0.01$ g/cm^3. (R.V.J.)

30438 SOLUBILITY ISOTHERM (25°) IN $Y(NO_3)_3-NH_4NO_3-HNO_3-H_2O$ SYSTEM. F. M. Perel'man and I. Z. Babievskaya (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim., 7: 1479-81(June 1962). (In Russian)

An attempt was made to prepare binary yttrium nitrate-ammonium nitrate in nitric acid. The solubility isotherm (25°) in $Y(NO_3)_3-NH_4NO_3-HNO_3-H_2O$ at 34% HNO_3 was studied and three types of salt were found: $Y(NO_3)_3 \cdot 4H_2O$, $Y(NO_3)_3 \cdot 2NH_4NO_3$, and NH_4NO_3. The composition of the liquid phase at the eutectic point between NH_4NO_3 and $Y(NO_3)_3 \cdot 2NH_4NO_3$ is 13% $Y(NO_3)_3$, 49.9% NH_4NO_3, and between $Y(NO_3)_3 \cdot 4H_2O$ and $Y(NO_3)_3 \cdot 2NH_4NO_3$, it is 18.8% NH_4NO_3 and 42% $Y(NO_3)_3$. (R.V.J.)

30439 INVESTIGATION OF COMPLEX FORMATION OF Hf WITH FLUORO-CONTAINING β-DIKETONES BY DISTRIBUTION METHOD. V. M. Peshkova and Peng An. Zhur. Neorg. Khim., 7: 1484-5(June 1962). (In Russian)

The analysis of Hf complexing with thenoyltrifluoroacetone (TTA) and selenenoyltrifluoroacetone (STA) showed that $Hf(STA)_n$ is less stable than $Hf(TTA)_n$. Distribution coefficients ($d = q_{Zr}/q_{Hf}$) for these β-diketones at various concentrations in 1 M $HClO_4$ were found. The mean values are $D_{TTA} = 12.3$ and $D_{STA} = 15.8$, showing that for Zr and Hf separation STA is a better reagent than TTA. (R.V.J.)

30440 KINETICS OF HYDROGEN REDUCTION OF Nb_2O_5. P. V. Gel'd and V. D. Lyubimov. Zhur. Priklad. Khim., 35: 1472-9(July 1962). (In Russian)

The kinetics of hydrogen reduction of Nb_2O_5 to NbO_2 at 760 to 1060°C and 20 to 740 mm Hg pressure indicate an autocatalytic process. The activation energy of the reduction is about 24 kcal/g-atom. The reaction rate increased proportionally with hydrogen pressure (0.6). Even small amounts of water vapor depressed the reduction process. The electric conductivity of Nb_2O_5 and the reduction products increased exponentially with temperature. (R.V.J.)

30441 NUMERICAL COMPUTATION OF TIME-DEPENDENT PROPERTIES OF ISOTOPICALLY DISORDERED ONE-DIMENSIONAL HARMONIC CRYSTAL LATTICES. Robert J. Rubin (National Bureau of Standards, Washington, D. C.). Prepublication Copy. 18p.

The statistical dynamical properties of isotopically disordered harmonic crystal lattices are numerically investigated. Two properties are studied in detail: the decay of initial periodic disturbances $\dot{Q}_k(\tau)$ which are normal modes of the same lattice structure when all particles have the same mass; and the dipole moment correlation function $\langle\dot{M}(0)M(\tau)\rangle$. The numerical calculation of the time evolution of either $\dot{Q}_k(\tau)$ or $\langle\dot{M}(0)M(\tau)\rangle$ involves the solution of a single initial value problem for a given random distribution of the isotope masses on the lattice sites. The time evolution is investigated for values of the isotope mass ratio M_1/M_2 and of k for which the perturbation results of Maradudin, Weiss, and Jepsen are not applicable. A new formulation of the formal solution of the normal mode decay problem is proposed. This formulation should make it possible to calculate the initial stages of decay in an infinite lattice for the extreme values of M_1/M_2 and k. (auth)

30442 AN X-RAY STUDY OF THE STRUCTURE OF THE ALKALINE EARTH OXIDE CATHODE. Paul Lublin (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). 39p.

To be published in Advances in X-Ray Analysis, Vol. 6, Plenum Press, New York.

An x-ray diffraction study was conducted on the emissive coating (Ba, Sr, CaO) of experimental diodes from which thermionic emission data were taken before x-ray analysis. The tubes were then opened and the oxide protected by special techniques in order to prevent the formation of the hydroxide. In addition to x-ray diffraction, other techniques were used to give a complete description of the structures present. (auth)

Radiation Chemistry and Radiochemistry

Refer also to abstract 30930.

30443 (ASD-TR-7-840A(V)) HYDRAZINE PROCESS DEVELOPMENT. Interim Technical Engineering Report, February through April 1962. R. I. Miller, R. L. Pearson, F. R. Standerfer, H. J. Snyder, H. T. Watanabe, and L. G. Carpenter (Aerojet-General Nucleonics, San Ramon, Calif.). Contract AF 33(600)-42996. 109p. (AGN-AN-584)

The program is to develop, design, construct and operate a continuous, in-reactor hydrazine production loop based on the fissio-chemical process. This fourth quarterly progress report describes particulate fuel behavior in hydroclones, filters, and a flocculating environment.

Alterations of the in-reactor loop, supporting components, and instrumentation, necessitated by a change in reactor facility are discussed. Equipment to be used for ammonia radiolysis, and for high energy compound and slurry radiation stability studies are described. (auth)

30444 (BNL-4920) ISOTOPIC HYDROGEN ION MOLECULE REACTIONS. B. G. Reuben and L. Friedman (Brookhaven National Lab., Upton, N. Y.). [1959]. Contract [AT(30-2)-Gen-16]. 35p.

The reactions of isotopic hydrogen molecule ions and hydrogen molecules were investigated using a mass spectrometer ion source as the reaction chamber. Phenomenological cross sections for reactions of ions and molecules of the pure gases, H_2, D_2, and HD, and mixtures of H_2-D_2, HD, H_2 and HD, and D_2 were determined as function of ion velocity. The nature of the kinetic energy distribution of the product ion was investigated, and collection efficiency studies on the reactant ions were used to relate observed cross sections to reaction rate constants. The kinetic data derived indicate reaction at every collision for the pure gases. Isotopic fractionation was observed in competitive processes in the mixtures. The mechanism of the reaction is discussed in terms of the isotopic rate data. (auth)

30445 (BNL-5065) ECONOMICS OF FISSION NEUTRON AND GAMMA CHEMO-NUCLEAR REACTORS FOR PRODUCTION OF ETHYLENE GLYCOL AND PHENOL. Meyer Steinberg and Leon Green (Brookhaven National Lab., Upton, N. Y.). Oct. 1960. Contract [AT(30-2)-Gen-16]. 11p.

An evaluation of neutron–gamma reactors in chemonuclear processes is presented. One type of process is characterized by low G values, and is usually endothermic, an example of which is the production of ethylene glycol. Another type, characterized by high G values, is usually exothermic; an example is the production of phenol. An analysis of factors to be considered in the radioinduced production of these and other compounds is presented. (J.R.D.)

30446 (HW-SA-2080) INHIBITION STUDIES IN REACTOR DECONTAMINANTS. R. D. Weed (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Jan. 1961]. Contract [AT(45-1)-1350]. 9p.

Dibasic ammonium citrate solutions have shown promise as decontaminants for high temperature water recirculating systems when preceded by an alkaline permanganate solution. The ammonium citrate solutions, when used at the effective conditions, give corrosion rates which are above the maximum desired rate in a nuclear reactor system containing carbon steel piping and other materials. A number of organic compounds were evaluated as inhibitors in solutions designed for decontamination of nuclear reactor systems. Of the compounds tested, tri-n-propylamine and tri-n-dodecylamine indicated the best inhibition at 85°C. It is postulated that with higher concentrations better inhibition will be obtained with these and the other organic inhibitors investigated. (auth)

30447 (NYO-10024) THE EFFECT OF ELECTROPHILIC ADDITIVES ON THE RADIOLYTIC PRODUCTS OF ORGANIC CHAIN REACTIONS. Quarterly Report, May 1962–July 1962. (Little (Arthur D.) Inc., Cambridge, Mass.). Aug. 1, 1962. Contract AT(30-1)-2904. 11p.

The high energy radioinduced reaction of isobutane and propylene was studied on SiO_2 and $Fe_2O_3-SiO_2$ at higher surface area coverages. The increase of yield with coverage is noted and discussed. Results are also presented on the irradiation of isobutane-propylene mixtures adsorbed on MnO_2-SiO_2 and ferric silicate, $Fe(SiO_2)$. The $Fe(SiO_2)$ gel shows a higher degree of selectivity than the $Fe_2O_3-SiO_2$ gels. (auth)

30448 (TID-15961) INHIBITION OF THERMAL AND HIGH ENERGY RADIATION POLYMERIZATION IN A MONOMER (thesis). John D. Zimbrick (Kansas. Univ., Lawrence). May 1962. 58p.

Experiments were carried out to determine the relationships between thermal gelation and radiation gelation of a monomer in the presence of various additives. The system of gel-phase formation as an indicator of gelation proposed by Hoecker was used throughout the experiments. Two of the additives tested in the first experiment were found to be sensitizing agents for radiation and thermal effects. Another of the additives, the aromatic compound triphenylstibine (TPS), appeared to be a much more efficient protective agent against thermal gelation than against radiation gelation. This behavior led to a detailed comparative study of the effects of TPS on the thermal and radiation gelation of a monomer. Results of the experiments show that TPS is a very efficient protector against thermal gelation, but not an efficient protector against radiation gelation. It was concluded that the sequence of events leading to thermally produced radicals may be different from that leading to radiation-produced radicals. TPS is greatly able to reduce the number of thermally produced radicals by somehow breaking the chain of events leading to their formation. A theory was proposed, based on the "sponge effect", whereby the TPS molecules might be able to cause the exhibited thermal protection. Another theory, based on experimental evidence that the benzene ring has a low rate of radical formation when exposed to ionizing radiation, was proposed which would explain the relatively small degree of protection which TPS gives a monomer against radiation gelation. The effect of x-ray energy on dose required to produce gelation for a 0.0025% TPS solution was determined. Results show that two regions of energy independence are present: one at low radiation energies and one at high radiation energies. It was proposed that different sequences of events leading to radical formations operate at different radiation energies. Those at low radiation energies are less efficient and require higher radiation doses to produce gelation than do those at high radiation energies. (auth)

30449 (TID-16432) EFFECTS OF IONIZING RADIATION ON VINYLIDENE CHLORIDE, CIS, TRANS-DIBROMOETHYLENE, TRIBROMOETHYLENE AND 2-FLUOROPROPENE (thesis). Ellis Norman Harold (Vanderbilt Univ., Nashville). June 1962. 73p.

Tribromoethylene and dibromoethylene were Co^{60}-gamma-irradiated in the liquid phase. Dichloroethylene and 2-fluoropropene were vapor-phase irradiated with soft x rays. The overall ability of radiation to cause molecular changes in the irradiated compound was measured in terms of their G values. The G value for 2-fluoropropene was found to be 26, and the value for vinylidene chloride 53. The G-value for dibromoethylene was 18 and the value for tribromoethylene was 149. Values obtained under various alternate conditions are also discussed. Other discussions are included concerning the general aspects of ionizing radiation and the experimental equipment and methods used in the investigation. (J.R.D.)

30450 (TID-16511) CHEMISTRY OF RADIOACTIVE COMPONENTS OF URANIUM MILL WASTES. M. A. DeSesa (National Lead Co. of Ohio, Cincinnati). [1961]. Contract [AT(30-1)-1154]. 22p.

The chemical behavior of Ra and Th in various milling circuits is considered to indicate the course of these ele-

ments through the various uranium concentration processes. The effect of disturbing the radioactive equilibrium between U and its daughter products is discussed in terms of subsequent problems in sampling and analysis. A review is made of published analytical procedures which resulted from the research program on possible radioactive pollution arising from U milling. (auth)

30451 (TID-16579) THE RADIOLYSIS OF DIBROMODICHLOROMETHANE AND THE Co-60 GAMMA-RAY INDUCED EXCHANGE BETWEEN CCl_2Br_2 AND Br_2. Larry L. Schwartz and Richard F. Firestone (Ohio State Univ. Research Foundation, Columbus). [1962]. Contract [AT (11-1)-1116]. 12p.

The radiolysis of air-free CCl_2Br_2 by gamma rays was investigated at temperatures from −196 to 131°C. An investigation of the radioinduced exchange between CCl_2Br_2 and Br_2 was also performed at 25 to 88°C with initial bromine concentrations in the range 0.016 to 0.021 M and at dose rates in the range 7×10^{16} to 7×10^{17} ev/liter min. Br_2 is the major free-halogen product at all temperatures; the proportion of Cl atoms among the free-halogen products is less than 5% at all temperatures in the liquid and solid phases. CCl_4, CCl_3Br, C_2Cl_4, and $C_2Cl_4Br_2$ were identified as radiolysis products. Four additional organic products were tentatively identified as $CClBr_3$, CBr_4, C_2Cl_3Br, and $C_2Cl_3Br_3$. (P.C.H.)

30452 THE DEPENDENCE OF RADICAL YIELD ON DOSAGE AND SPECIFIC IONIZATION IN SIMPLE SOLID AMINO ACIDS, AND AN INTERPRETATION BASED ON A DIFFUSION THEORY. O. Schirmer and K. Sommermeyer (Universität, Freiburg i. B.). Atompraxis, 8: 288-94(Aug. 1962). (In German)

Glycine, alanine, leucine, serine, and valine were irradiated with x rays and α rays, and the yield of radicals and paramagnetic centers was determined in relation to dosage in an EPR spectrograph (examination of electron spin resonance). In the case of glycine, x-irradiated monocrystals were also studied. The yield of centers after α-irradiation was 40 to 80% of that obtained with x-rays. With both x-ray and α-irradiation the yield of centers decreases with doses greater than ca. 10^6 rad. The yield from glycine monocrystals is approximately the same as that from powdered glycine, but the decrease in the yield commences only at a higher dosage level. The decrease in yield with increasing dosage and specific ionization is explained by a combination of the separated radicals (e.g., $\cdot H$, $\cdot NH_2$, $\cdot NH_3^+$) with the centers, i.e., the molecule trunk. It is assumed that the separated radicals can diffuse in the crystal. A diffusion theory was worked out in regard to the quantitative treatment of the process. From the experimental results it was deduced that the diffusion length of the radicals in crystal is 150 to 300 Å. In addition, irradiated dimethylglyoxime was also studied. The centers originate through the separation of electrons. The electrons combine with the centers much less frequently than do the radicals with the centers of the previously mentioned substances. (auth)

30453 ISOTOPIC COMPOSITION OF RADIOLYTIC HYDROGEN EVOLVED FROM MIXTURES OF BENZENE AND CYCLOHEXANE WITH THEIR DEUTERATED ANALOGUES P. J. Dyne and W. M. Jenkinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 40: 1746-57(Sept. 1962).

The isotopic composition of radiolytic hydrogen evolved from mixtures of benzene and cyclohexane with their deuterated analogues was measured. The data are interpreted in terms of first-order processes of the kinetic form (for C_6D_{12}) $C_6D_{12} \rightarrow C_6D_{11} + D_2$ and second-order processes $C_6D_{12} \rightarrow X_D + R$, $X_D + C_6H_{12} \rightarrow HD + R$. A complete kinetic analysis for the system $C_6D_6 - C_6H_6$ was made from measurements at the two ends of the concentration range. This gives a satisfactory prediction of the isotopic composition of hydrogen evolved from an equimolar $C_6H_6 - C_6D_6$ mixture. A first-order yield of D_2 is found in solutions of C_6D_{12} in benzene which persists to "zero" C_6D_{12} concentration. The mechanisms of the first-order process studied in these experiments, and of the "unscavengeable" or "molecular" yields of radiolytic hydrogen, are discussed. (auth)

30454 THE RADICAL SCAVENGING REACTION OF DDPH IN A SOLID POLYMER. Seizo Okamura, Tomonobu Manabe, and Yahiko Toriuchi. Dôitai to Hôshasen, 4: 13-20(May 1961).

Polymethyl methacrylate (PMMA) films containing DPPH were irradiated with Co^{60} γ rays at 5×10^4 to 1.8×10^5 r/hr in air. The disappearance of DPPH in the polymer was measured spectroscopically. The G-value of the radical formation of PMMA calculated from the DPPH disappearance rate was 2.8 which was much smaller than the 12.5 for MMA. The critical concentrations of DPPH in solid polymers were also found to be much higher than those in solution. Hence, the efficiencies of the radical scavenging reaction of DPPH in solid polymers were lower than those in liquids. The protective effects of DPPH on PMMA observed during the radiation decomposition of the latter were probably due to the capture of side-chain radicals. The scavenger reaction of DPPH for radicals produced by the thermal decomposition of benzoyl peroxide in PMMA is also discussed. (OID)

30455 THE EFFECTS OF METALLIC IONS ON γ-RAY INITIATED POLYMERIZATION OF ACRYLONITRILE IN AN AQUEOUS SOLUTION. Seizo Okamura, Koichiro Hayashi, and Masahiro Sakamoto. Dôitai to Hôshasen, 4: 21-8(May 1961).

Studies were made on 0.8 N H_2SO_4 solutions, containing $CuSO_4$, $FeSO_4$, Na_2SO_4, $CdSO_4$, $ZnSO_4$, $CoSO_4$, $Al_2(SO_4)_3$, $NiSO_4$, $MgSO_4$, $MnSO_4$, and $HgCl_2$ as metallic salts, which were irradiated with Co^{60} γ rays. Results showed that the presence of the metallic ions retarded the polymerization rate and reduced the molecular weight of the polymer. This was quite apparent in cases with Fe^{2+} and Cu^{2+} ions. (OID)

30456 RADIATION-OXIDATION OF SILICONES. Kenji Ohdan, Koichiro Hayashi, and Seizo Okamura. Dôitai to Hôshasen, 4: 57-63(May 1961).

Silicone samples sealed in air glass ampoules attached to a Hg manometer were γ irradiated. The rates of peroxide formation and gas evolution were determined iodometrically with isopropanol as the solvent. It was observed that the oxygen absorption was not a diffusion-controlled process in a rather wide range of partial pressures from the samples. This was further supported by the lack of variations in the G-values observed in the samples with widely different bulk viscosities. Hence, the critical viscosity for a diffusion controlled process is between 100 and 500 centistokes. A protecting effect by the phenyl group was observed for methyl phenyl silicone fluid. The rate of peroxide formation fitted the exponential equation of the radiation dosage and was equivalent to about $\frac{1}{4}$th of the oxygen absorbed by the silicone sample. The peroxide formed proved to be capable of initiating the polymerization of the acrylonitrile monomer into a graft copolymer. (OID)

30457 TECHNIQUES FOR USING TRITIUM GAS. Kiyoteru Yamada and Yoshishige Sato. Dôitai to Hôshasen, 4: 64-6(May 1961).

Suggestions and directions are described for handling and transferring tritium gas. Ampoules for separating a small quantity of tritium from a large source, apparatus for the electric discharge method and air injecting, apparatus for glass blowing, apparatus for tritium labeling by the electric discharge and the exposure methods, and an aspirator for the enrichment and reduced-pressure distillation of tritium are discussed. (OID)

30458 RADIATION-INDUCED POLYMERIZATION OF CYANURIC CHLORIDE. Seizo Okamura. Dôitai to Hôshasen, 4: 69(May 1961).

The results of irradiating trichloro-s-triazine by γ rays in the solid phase are reported. The polymerization yield was determined gravimetrically. A 69.8% yield of white powder was obtained by irradiation at 3×10^4 r/hr up to 1.38×10^5 r at 16°C and a pale yellow powder of 61.8% yield was obtained at 5×10^3 r/hr up to 8.04×10^5 r at 100°C. The polymer obtained was insoluble in methyl alcohol and benzene, had a min mp of 260°C, and an intrinsic viscosity in dimethylformamide of 0.1–0.2 at 30°C. (OID)

30459 RADIATION-INDUCED POLYMERIZATION OF NITRILE COMPOUNDS. Seizo Okamura, Koichiro Hayashi, and Yoko Nakamura. Dôitai to Hôshasen, 4: 69-70(May 1961).

Analyses of the elastic polymer obtained by means of Co^{60} γ radiation at a dosage rate of $1.68 \times 1.68 \times 10^4$ r/hr to $1/95 \times 10^4$ r/hr up to dosages of 9.2×10^5 r to 5.6×10^6 r from −78 to 20°C on nitrile compounds, such as acetonitrile, proprionitrile, and isobutyronitrile in liquid or solid phase are described. The spectra of the dark brown polymers showed that the structure of the main chain was the conjugated double bond of $-C = N-$. The degree of polymerization was small and corresponded to the G-value range of 8 ~ 20. The polymer did not have an obvious melting point and was soluble in acetonitrile and dimethylformamide, but not in alcohol, benzene, and cyclohexane. (OID)

30460 RADIATION-INDUCED POLYMERIZATION OF ACETONE AND HALOGENOACETONE. Seizo Okamura, Koichiro Hayashi, and Sumihiko Mori. Dôitai to Hôshasen, 4: 70-2(May 1962).

A method for obtaining an inexpensive and pure elastic polymer from acetone is described. Carefully purified and dried acetone frozen below its melting point (−95°C) was irradiated by Co^{60} γ rays in vacuo ($<10^{-4}$ mm). The unreacted acetone was removed by distillation under reduced pressure. The yield of the polymer was 1 ~0.1%, and the G-value was 30 ~ 500. The polymer was soluble in acetone, chloroform, and CCl_4, and its stability could be increased slightly by irradiating in the presence of a small amount of a vinyl compound. Observations made on the absorption spectrum suggested that the main chain consisted of a structure of polyether-type group at the end. Successful halogenation was obtained by irradiating a purified bromoacetone sample at −78°C ($<10^{-4}$ mm), and a yield of 13% was obtained. Only 0.12% yield was obtained in the case with chloroacetone. The monomers contributed to the thermal stability, graft copolymerization, cross-linking vulcanization, and dye properties by means of the halogen atom. (OID)

30461 COMMENT ON THE CORRELATION OF PRODUCT YIELDS IN THE GAS-PHASE RADIATION CHEMICAL REACTION WITH MASS SPECTRAL DATA. Kenji Fueki, Hiroshi Otoma, and Kôzô Hirato. Dôitai to Hôshasen, 4: 72-3(May 1961).

The changes of relative amounts of various ions in irradiated methanol with respect to changing time were studied. The number of CH_3OH^+ ions produced in the primary decomposition stage of molecular ions reached a maximum after approximately 10^{-9} sec. The number of COH^+ ions produced in the secondary decomposition stage was almost nil at 10^{-11} sec, but increased after a time lag. The molecular ion, CH_3OH^+, decreased with increasing time. Little change in the CH_3^+ ions with time was noted, but most of the ions showed significant changes in the relative number of ions in the neighborhood of 10^{-10} sec. (OID)

30462 RADIATION-INDUCED POLYMERIZATION OF 3,3-BISCHLOROMETHYLOXACYCLOBUTANE. Seizo Okamura, Koichiro Hayashi, and Haruhiko Watanabe. Dôitai to Hôshasen, 4: 73-4(May 1961).

Optimum conditions for obtaining radioinduced polymerization of 3,3-bischloromethyloxacyclobutane were the irradiation of relatively large single crystalline state monomers in air by Co^{60} γ rays at 2.8×10^3 r/hr at 11.2°C in the solid phase. The yield obtained reached a maximum point and had a mp of 171 ~ 176°C. (OID)

30463 A STUDY OF THE MECHANISM BY WHICH A PRELIMINARY IRRADIATION AFFECTS THE THERMAL DECOMPOSITION OF SILVER OXALATE CONTAINING A CADMIUM IMPURITY. Yu. A. Zakharov, V. V. Boldyrev, V. M. Lykhin, L. A. Votinova, G. G. Savel'ev, and A. Kh. Breger (Kirov Polytechnical Inst., Tomsk, USSR and Karpov Inst. of Physical Chemistry, USSR). Doklady Akad. Nauk S.S.S.R., 145: 122-4(July 1, 1962). (In Russian)

Preparations of pure silver oxalate, and of oxalate containing 0.1, 0.5, 1, 5, 7.5, and 10 mole % cadmium were prepared by precipitation. Cadmium oxalate could be detected as a separate phase by x-ray analyses, when added in amounts exceeding 1.0 mole %. The rate of photolysis on irradiation with ultraviolet light, and the rate of radiolysis were determined by measuring the pressure of evolved gas in a high-vacuum unit. The addition of cadmium significantly slows down the rate of photolysis of silver oxalate, and to a lesser degree, it also slows down the radiolysis of silver oxalate by x rays. A study of the thermal decomposition of irradiated and unirradiated samples shows that the addition of cadmium, and preliminary irradiation have an effect only on the initial induction period of the decomposition. The addition of cadmium increases the induction period, and a preliminary irradiation shortens the period. The rate of thermal decomposition at temperatures of 132, 136, and 140°C was determined on samples containing varying amounts of cadmium which were preliminarily given doses of Co^{60} γ rays of 9.9×10^5, 1.0×10^7, and 9.4×10^7 roentgens per gram. (TTT)

30464 THE POSSIBILITY OF CHANGING THE SENSITIVITY OF AN EMULSION DURING ITS IRRADIATION. D. M. Samoilovich, E. S. Barinova, and I. V. Ardashev. Doklady Akad. Nauk S.S.S.R., 145: 557-9(July 21, 1962). (In Russian)

One method of controlling the sensitivity of a nuclear emulsion is to irradiate the emulsion in the presence of free hydrogen ions. Free H^+ ions compete with Ag^+ ions in the emulsion for the capture of electrons, and decrease the sensitivity of the emulsion. Type P emulsion 400 μ thick was subjected to irradiation with γ quanta and neutrons from a Po-Be source. Traces of fast electrons and of recoil protons (E ~ 10 Mev) were analyzed. The emulsion was immersed for one hour in an acid solution with a pH varying from a value of 1 to 5, in order to swell the emulsion, and the irradiation was carried out with the emulsion immersed in a solution of the same pH. After irradiation the emulsions were washed, held for 12 hours at a pH of 7, and then developed. A sharp drop in track density was observed on decreasing the pH from 3 to 2.

No traces of relativistic particles could be observed at these low pH values. In a second series of experiments the emulsion was irradiated with 8.6 Bev protons, and after irradiation the emulsion was treated with H_2SO_4 and HNO_3 solutions of different pH, and then was rinsed and developed. No noticeable decrease in the density of fast electron tracks was observed at a pH of 2 or higher, but a large decrease in the density and number of tracks was observed at a pH between 1 and 2. The density of proton tracks in the same emulsion did not change. In a third series of experiments the emulsion was subjected to irradiation by a Po-Be source and was then given an acid treatment. No change in the density of recoil proton tracks was observed at a pH of 2 or higher. A 10% decrease in density is obeserved at a pH of 1. Thus, the sensitivity of a nuclear emulsion can be varied by changing the concentration of hydrogen ions in the emulsion during the process of irradiation. (TTT)

30465 TEMPERATURE DEPENDENCE OF ESR SPECTRA OF IRRADIATED POLYTETRAFLUOROETHYLENE. Naoyuki Tamura (Japanese Assn. for Radiation Research on Polymers, Tokyo). J. Chem. Phys., 37: 479-84(Aug. 1, 1962).

The double quintet spectrum in the ESR spectra of irradiated polytetrafluoroethylene, which is identified as the radical $—CF_2\dot{C}FCF_2—$, varies its spectral shape with temperature. The changes in the linewidths of component lines in room-temperature region are compared with the results of NMR and dynamic mechanical properties and are ascribed to the rotational motion of chains in crystalline regions. The change of isotropic splittings of the quintet from 61 G in rigid state to 32 G in motional state is due to the motional averaging of angular dependences of the β fluorines relative to p orbital of the radical carbon atom. With the triplet spectrum the variation of hyperfine structure with temperature is observed, which is also due to molecular motions. (auth)

30466 THE EFFECTS OF γ-IRRADIATION ON MODEL COMPOUNDS OF LIGNIN. Setsuo Takamuku and Yoshikazu Hachihama. Kôgyô Kagaku Zasshi, 65: 93-5(Jan. 1962).

The reaction mechanism of samples of coniferyl aldehyde methyl ether (CAM), a model compound of lignin, was studied. The samples were sealed in glass tubes (15 × 150 mm) and irradiated with γ rays from a 1500-c Co^{60} source in the presence of air at room temperature. The color reaction of CAM became negative and its optical density at 335 mμ decreased after the irradiation at 2×10^6 r of its alcohol or dioxane solution. The reaction product molecular weight was about 1000 corresponding to that of the pentamer of CAM. The double bond was not observed, but the hydroxyl groups were identified in the product by infrared spectra. The CAM structure is discussed and compared against a polyacrolein formula. (OID)

30467 THE EFFECT OF IRRADIATION ON A POLYMER BLEND. I. THE EFFECT ON A MIXTURE OF HIGH DENSITY AND LOW DENSITY POLYETHYLENE. Sanyo Hori. Nagoya Kôgyô Gijutsu Shikenjo Hôkoku, 11: 48-52 (Jan. 1962).

The blending technique utilizing the radioinduced cross linking was found to be effective in preventing the separation of the blending polymer. High and low-density samples with mp's of 139 and 114°C, respectively, and containing 5, 10, 15, and 20 wt % of the former were irradiated by γ rays from a 3-kc Co^{60} source at the rate of 0.4 Mr/hr at room temperature and at 150°C up to 10, 20, and 30 Mr. Results of the measurements of specific gravity, specific volume-temperature, specific heat-temperature, and elasticity were compared with those obtained from unirradiated samples. It was concluded that the homogeneous blending occurred only when the mixtures were irradiated in the melted state when uniform crystallization resulted during the cooling process. (OID)

30468 RADIOLYSIS OF COMPOUNDS OF THE NOBLE METALS IN AQUEOUS SOLUTION. I. ACTION OF GAMMA RAYS ON THE CHLORIDES OF Pt^{II} AND Pt^{IV} IN ACID SOLUTION. M. Haïssinsky (Laboratoire Curie, Paris). Radiation Research 17: 274-85(Sept. 1962).

The oxidation of K_2PtCl_4 in aerated aqueous solution by Co^{60} γ-rays was studied over a large range of concentrations and at diverse pH. The yield increases with the concentration of solute and of H^+ ions. An important aftereffect has been shown to exist. Under optimal conditions, the total initial yield $G(Pt^{IV}) = 7.8$. In degassed dilute solution the solute is unchanged, but small quantities of H_2 and O_2 are formed. No significant change has been observed in solutions of Pt^{IV}. The results on the oxidation of Pt^{II} can readily be interpreted by the assumption that the free radicals OH and HO_2, as well as H_2O_2, oxidize Pt^{II} to Pt^{IV}, whereas H atoms produce the reverse reaction. The catalytic decomposition of hydrogen peroxide in the presence of platinum salts explains most of the other observations of the kinetics. In concentrated solutions of K_2PtCl_4, a faint precipitate of metallic platinum is formed, and this is attributed to a direct effect of the radiation. (auth)

30469 PHOTOLYSIS OF DILUTE HYDROGEN PEROXIDE SOLUTION IN THE PRESENCE OF DISSOLVED HYDROGEN AND OXYGEN. EVIDENCE RELATING TO THE NATURE OF THE HYDROXYL RADICAL AND THE HYDROGEN ATOM PRODUCED IN THE RADIOLYSIS OF WATER. C. J. Hochanadel (Oak Ridge National Lab., Tenn.). Radiation Research, 17: 286-301(Sept. 1962).

The kinetics of photolysis of hydrogen peroxide in the presence of hydrogen and oxygen have been studied. From the proposed mechanism, $k_{H_2+OH}/k_{H_2O_2+OH} = 0.93$ and $k_{H_2O_2+H}/k_{O_2+H} = 2.2 \times 10^{-3}$. Studies in perchloric acid solution showed that neither competition is sensitive to hydrogen ion concentration in the range up to 0.4M. Both sulfuric acid and hydroxyl ion react with OH radicals to give species (HSO_4 and O^-) which do not react with H_2. Ratios of rate constants were $k_{H_2+OH} : k_{HSO_4^-+OH} : k_{OH^-+OH} = 1 : 0.005 : 8$. Comparison with results from radiolysis of water shows: (1) the OH radicals produced by photolysis of hydrogen peroxide and the hydroxyl radicals produced in the radiolysis of water have the same chemical structure; (2) the hydrogen atoms produced by reaction of H_2 with OH are probably true H atoms; other evidence indicates that these can react with hydrogen ions to produce a more acid form, presumably H_2^+; (3) the hydrogen atoms produced in the radiolysis of water are probably e_{aq}^- which are converted by hydrogen ions to true H atoms. (auth)

30470 RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF ETHANOL AND THE NATURE OF THE OXIDIZING RADICAL OH. Andries Hummel and A. O. Allen (Brookhaven National Lab., Upton, N. Y.). Radiation Research, 17: 302-11(Sept. 1962). (BNL-6147)

Solutions containing ethanol, bromide ion, and oxygen have been irradiated with γ-rays. The accepted mechanism for the oxidation of alcohol has been confirmed, and the competition for OH between Br^- and C_2H_5OH has been demonstrated. The OH radical reacts somewhat faster with ethanol than with bromide ion. Addition of inert salts had no effect on this competition, which demonstrates that the radical is in fact a neutral species and is best represented by the conventional formula OH. (auth)

30471 THE FLASH PHOTOLYSIS OF WATER AND AQUEOUS SOLUTIONS. J. H. Baxendale (Argonne National Lab., Ill.). Radiation Research 17: 312-26(Sept. 1962).

Transient species absorbing in the ultraviolet are produced in the flash photolysis of aerated water and a variety of aqueous solutions. The flash irradiation of water alone and of aerated water and dilute aerated solutions of methanol produces hydrogen peroxide in amounts consistent with the primary production of H and HO from the photolysis of water. The transient absorption at 254 mμ produced in dilute aerated methanol solutions shows second-order decay kinetics, and the decay rate is enhanced considerably by the presence of Cu^{2+}. The observations are consistent with the absorption being due to the radical HO_2. Rate constants for the processes $HO_2 + HO_2$ and $Cu^{2} + HO_2$ have been obtained. (auth)

30472 THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF CYTOCHROME c. Joseph Rabani and Gabriel Stein (The Hebrew Univ., Jerusalem). Radiation Research, 17: 327-40(Sept. 1962).

Ferricytochrome c is reduced to ferrocytochrome c in aqueous solutions irradiated with x-rays in the absence as well as in the presence of O_2. The dependence of the initial reduction yield, Gr^0, on the concentration of cytochrome c, on added H_2, O_2, methanol, glycine, alanine, and formate, and on pH was investigated. A reaction mechanism involving reduction of ferricytochrome c by e_{aq}, H, and O_2^- and by organic free radicals RH (formed by the attack of OH on RH_2) is derived. Rate constants are included. (auth)

30473 RADIATION CHEMISTRY OF COMPOUNDS CONTAINING THE PEPTIDE BOND. Warren M. Garrison and Boyd M. Weeks (Univ. of California, Berkeley). Radiation Research 17: 341-52(Sept. 1962). (UCRL-10192)

Radiation-induced reactions of peptides in solution and in the solid state are described. It is shown that the original proposal regarding the reactivity of the ~ NH–CH(R) ~ locus is in accord with the more recent chemical and physical evidence. A specific radiation-chemical role is assigned to the hydrogen-bond structure. (auth)

30474 RADIATION CHEMISTRY OF CYCLOHEXANE. V. DILUTE SOLUTIONS OF BENZENE IN CYCLOHEXANE. J. A. Stone and P. J. Dyne (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiation Research, 17: 353-65(Sept. 1962).

The principal products observed in the radiolysis of dilute solutions of benzene in cyclohexane—i.e., hydrogen, cyclohexene, bicyclohexyl, and cyclohexylhexene-1—are the products of radiolysis of pure cyclohexane but are formed in much lower yield. New products found are polymer (G ~ 1 at 0.1M benzene) and phenylcyclohexane (G ~ 0.2). The G value for the disappearance of benzene is ~0.3 at this benzene concentration. Tracer experiments have eliminated reactions in which benzene scavenges hydrogen atoms forming $C_6H_7\cdot$, the $C_6H_7\cdot$ radical then transferring the captured H atom back to a hydrocarbon radical. These tracer experiments, together with the small participation of benzene in the products, show the major interaction of benzene to be nonchemical. (auth)

30475 ON THE RADIATION STABILITY OF SOLID ORGANIC COMPOUNDS. V. V. Voevodskii and Yu. N. Molin (Inst. of Chemical Kinetics and Combustion of the Siberian Department of the USSR Academy of Sciences, Novosibirsk). Radiation Research, 17: 366-78(Sept. 1962).

A hypothesis associating the value of radiation-induced yields in free radicals, G_R, with the position of the lowest excited level, E_1, is put forward. The conclusions drawn from this hypothesis as to the routes of secondary reactions involving hydrogen atoms formed in radiolysis are consistent with experimental results. (auth)

30476 SOLUTE COMPETITION FOR THERMAL ELECTRONS IN GAMMA-IRRADIATED ORGANIC GLASSES AT –196°C. John P. Guarino, Michael R. Ronayne, and William H. Hamill (Univ. of Notre Dame, Ind.). Radiation Research, 17: 379-87(Sept. 1962).

Comparison of the absorption spectra in tetrahydro-2-methylfuran at –196°C of alkali naphthalenide or biphenylide with γ-irradiated solutions of naphthalene or biphenyl demonstrates electron attachment in the latter. Gamma-irradiated glassed solutions in hydrocarbons show the same effect. Including a second solute which competes for electrons in γ-irradiated samples decreases G(naphthalenide) or G(biphenylide) and provides a measure of the electron-attaching efficiency of the second solute; twenty-seven solutes were tested, some in two solvents. (auth)

30477 ASPECTS OF THE RADIATION CHEMISTRY OF FLUID AND RIGID AQUEOUS SOLUTIONS CONTAINING NITROUS OXIDE AND FERROUS IONS. F. S. Dainton and F. T. Jones (Univ., Leeds, Eng.). Radiation Research, 17: 388-98(Sept. 1962).

Measurements were made of $G(N_2)$, $G(H_2)$, and $G(O_2)$ for solutions of N_2O in aqueous mineral acids of varying composition over the temperature range 77° to 350°K. Whenever a change in condition causes a transition from a crystalline or a fluid state to a glassy state, $G(N_2)$ increases abruptly but $G(O_2)$ and $G(H_2)$ are largely unaffected. Yields of Fe^{3+}, N_2, and H_2 have been measured when 5 M H_2SO_4 glasses at 77°K containing Fe^{2+} and N_2O are irradiated with 2537-A light or cobalt-60 γ-rays. These results and E.S.R. and low-temperature spectrophotometry data are all consistent with the hypothesis that electrons generated in the primary act migrate distances of about 50 A in the glass and will always react with any solute (N_2O or Fe^{2+}) they encounter during this migration. It is suggested that the polymer chains containing repeat units $(-SO_3-)_n$, $(-HPO_3-)_n$, or $(\rightarrow HClO_4\rightarrow)_n$, which are probably responsible for the glassy structure, may also furnish preferred paths for electron migration. (auth)

30478 EFFECT OF DENSITY IN RADIOLYSIS OF AMMONIA. Y. Toi, D. B. Peterson, and Milton Burton (Univ. of Notre Dame, Ind.). Radiation Research, 17: 399-407 (Sept. 1962).

A study of the effect of density on the radiolysis of ammonia at 137°C reveals sharp decreases in $G(H_2)$ and $G(N_2)$ in the density region ~0.05 to 0.15 gm cc^{-1}. At densities less than ~0.05 gm cc^{-1}, $G(H_2) = 6.2$, and $G(N_2) = 2.0$; at densities exceeding 0.15 gm cc^{-1}, $G(H_2)$ and $G(N_2)$ are about 1.5 and 0.4, respectively. It is notable that the G values begin to level off at densities well below the critical density of 0.235 gm cc^{-1}. The results are interpreted in terms of the Magee-Funabashi theory of ion clusters. It is assumed that the formation of such clusters reduces the probability of dissociative neutralization of ions by permitting the energy of neutralization to be spread over the molecules of the cluster. Although this interpretation is consistent with the observed density dependence of $G(-NH_3)$, contributions from other effects, in particular deactivation of excited species, may also be involved. (auth)

30479 THE RADIOLYSIS OF AQUEOUS SOLUTIONS AT HIGH INTENSITIES. J. K. Thomas and Edwin J. Hart (Argonne National Lab., Ill.). Radiation Research, 17: 408-18 (Sept. 1962).

The radiolysis of aqueous solutions at high intensities (up to 9×10^{27} ev l^{-1} sec^{-1}) has been studied and the kinetic results have been examined in the light of the existing radi-

cal theory of aqueous solutions. Single intense pulses of 13-Mev electrons produced by the Argonne linear accelerator were used throughout the present work. The duration of the pulses varied from 0.4 to 5 μsec. The dosimetry at these high intensities was carried out by comparison of the irradiated system with the Fricke dosimeter, the appropriate calibrations of this system under the experimental conditions being listed. The radiolysis of deaerated 0.8 N H_2SO_4 solutions was studied in detail, and it was found that at intensities less than 10^{26} ev l^{-1} sec^{-1} H_2 and H_2O_2 were produced with $G(H_2) = G(H_2O_2) = 1.23 \pm 0.06$. This yield of H_2 was reduced by initially adding H_2O_2 to the system. It was possible to account for the results by citing accepted radical-type reactions. Computations of these results gave reasonable estimates of the absolute and relative values of the radical-radical and radical-solute reactions. At higher intensities, i.e., above 10^{26} ev l^{-1} sec^{-1}, it was not possible to describe the above system simply in terms of accepted radical reactions, and the explanation in this case is at present uncertain. (auth)

30480 SUPEREXCITED STATES OF MOLECULES. Robert L. Platzman (Faculte des Sciences, Paris and Argonne National Lab., Ill.). Radiation Research, 17: 419-25 (Sept. 1962).

Normal molecules possess neutral excited states having excitation energy in excess of the ionization energy in which ionization does not always occur. These superexcited states play an important role in the radiation chemistry of gases, and perhaps also in the radiation chemistry of condensed phases. Some of their possible manifestations are explored. (auth)

30481 SPECTRAL INVESTIGATION OF CHEMICAL TRANSFORMATIONS IN CRYSTALLINE TRIPHENYLMETHANE. M. T. Shpak, A. V. Solovyov, N. I. Sheremet, and I. P. Dmitrenko. Ukrain. Fiz. Zhur., 7: 422-9(Apr. 1962). (In Ukrainian)

Irradiation with light and β rays of crystalline triphenylmethane cooled to low temperatures is found to result in the formation of several types of unstable luminescence centers, which vanish when irradiated samples are kept in an oxygen atmosphere at room temperature and may be preserved for several months in the absence of oxygen. Unstable luminescence centers are also formed by thorough mechanical grinding. An investigation of the luminescence spectra of the unstable luminescence centers in irradiated triphenylmethane shows that one type of center consists of triphenylmethyl radicals. (auth)

Raw Materials and Feed Materials

30482 (K-1448) THE VAPOR PRESSURE OF URANIUM PENTAFLUORIDE IN THE SOLID AND LIQUID STATES. Alexander S. Wolf, J. C. Posey, and Karl E. Rapp (Oak Ridge Gaseous Diffusion Plant, Tenn.). Sept. 5, 1960. Contract W-7405-eng-26. 21p.

Equations for the vapor pressure of uranium pentafluoride were derived. The melting point of uranium pentafluoride was determined both by experiment and by simultaneous solution of the solidus and liquidus vapor pressure equations. Physical properties of uranium pentafluoride determined besides vapor pressure were: melting point = 348°C (experimental); 353°C {+13, −16} (simultaneous solution); heat of vaporization (solid) = 36.6 ± 3.0 kcal/mole; heat of vaporization (liquid) = 24.7 ± 3.8 kcal/mole; and heat of fusion = 11.9 ± 4.2 kcal/mole. (auth)

30483 (NUMEC-P-23) OPTIMIZING URANIUM FEED ENRICHMENT FOR RECYCLE OPERATION. Karl H. Puechel (Nuclear Materials and Equipment Corp., Apollo, Penna.). Jan. 25, 1961. Contract AT(30-1)-2389. 15p.

Given a particular batch of spent fuel and knowing the desired final rejuvenated uranium enrichment, any uranium feed enrichment between the desired value and the highest possible enrichment can be utilized. Calculations were carried out to determine the optimum feed enrichment using AEC price schedules and assuming various values for U–Pu separation and chemical conversion costs. It is shown that the ratio of optimum feed enrichment to initial spent fuel enrichment is independent of the desired final enrichment and varies linearly with the separation cost. (auth)

30484 A METHOD OF CONCENTRATING COMPOUNDS OF URANIUM. (to Oesterreichische Studiengesellschaft Fuer Atomenergie Gesellschaft m.b.H.). British Patent 904,569. Aug. 29, 1962.

A method of separating uranium from solutions containing mineral acids is given which uses adsorption on basic anionic exchangers, such as Amberlite IRA-400 and Dowex-1 and -2. The method uses solutions of uranium salts in an organic solvent, e.g., alcohols, ketones, ethers, and esters, because thereby the distribution coefficient is increased by a factor of 100 to 1000 or more over aqueous solutions. The distribution coefficients of uranium in Dowex-1 are compared for the acids HCl, HNO_3, and H_2SO_4 and for the solvents ethanol, methanol, acetone, ethyl ether, ethyl acetate, and water. (D.L.C.)

30485 IMPROVEMENTS IN OR RELATING TO PURIFICATION OF PLUTONIUM. Leslie Airey (to United Kingdom Atomic Energy Authority). British Patent 905,274. Sept. 5, 1962.

The usual oxalate precipitation method for final purification of Pu from irradiated uranium is modified so that further oxalate precipitations can be carried out. The Pu oxalate precipitate is oxidized by ozone or anodic oxygen in HNO_3 solution to decompose the oxalate and dissolve the Pu, and the resulting solution may then be treated again for precipitation of Pu oxalate. (D.L.C.)

30486 METHOD OF PRODUCING URANIUM DIOXIDE POWDER. (to Mitsubishi Kinzoku Kogyo Kabushiki Kaisha). British Patent 905,371. Sept. 5, 1962.

A method is given for preparing a UO_2 powder of uniform quality, high particle density, and excellent packing characteristics for swaging and other fabrication methods. The method comprises adding an aqueous ≤ 28 wt % NH_3 solution to a refined aqueous solution of uranyl salt containing less than 100 g U/l. The rate of NH_3 addition is less than 100 g NH_3 per 1000 g U per minute, and the temperature is less than 100°C. The precipitated ammonium diuranate is thermally decomposed to form UO_3 or U_3O_8, which is then reduced and sintered in H_2 at 1200 to 1750°C. The resulting UO_2 powder has an average particle size of 2 to 150 μ, a particle density of ≥ 98%, and excellent sintering properties. (D.L.C.)

30487 STRIPPING OF URANIUM FROM ORGANIC EXTRACTANTS. D. J. Crouse, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,052,513. Sept. 4, 1962.

A liquid-liquid extraction method is given for recovering uranium values from uranium-containing solutions. Uranium is removed from a uranium-containing organic solution by contacting said organic solution with an aqueous ammonium carbonate solution substantially saturated in uranium values. A uranium-containing precipitate is

thereby formed which is separated from the organic and aqueous phases. Uranium values are recovered from this separated precipitate. (AEC)

30488 PROCESS FOR RECOVERING URANIUM FROM AQUEOUS PHOSPHORIC ACID LIQUORS. J. M. Schmitt (to U. S. Atomic Energy Commission). U. S. Patent 3,052,514. Sept. 4, 1962.

A liquid-liquid extraction method is given for recovering uranium values from aqueous solutions. An acidic aqueous solution containing uranium values is contacted with an organic phase comprising an organic diluent and the reaction product of phosphorous pentoxide and a substantially pure dialkylphosphoric acid. The uranium values are transferred to the organic phase even from aqueous solutions containing a high concentration of strong uranium complexing agents such as phosphate ions. (AEC)

30489 EXTRACTION OF URANIUM FROM AQUEOUS ACIDIC SOLUTION BY A POLYMER CHARACTERIZED BY THE APPEARANCE OF REPEAT UNITS CONTAINING ORTHO HYDROXY AROMATIC CARBOXYLIC ACID FUNCTIONS. Lorraine Guy Donaruma (to E. I. du Pont de Nemours and Co.). U. S. Patent 3,052,515. Sept. 4, 1962.

A process for the extraction of U from solutions comprises contacting the solutions under acid conditions with polymers containing repeated units with ortho hydroxy aromatic carboxylic acid functions. These polymers are simple to prepare, e.g., by condensation of salicylic acid with formaldehyde using oxalic acid as catalyst, and can be used in ion exchange column form. Several examples are given of the preparation of such polymers and their use in separating U from ores. (D.L.C.)

30490 METHOD OF PRODUCING URANIUM METAL BY ELECTROLYSIS. Roger D. Piper (to U. S. Atomic Energy Commission). U. S. Patent 3,052,611. Sept. 4, 1962.

A process is given for making uranium metal from oxidic material by electrolytic deposition on the cathode. The oxidic material admixed with two moles of carbon per one mole of uranium dioxide forms the anode, and the electrolyte is a mixture of from 40 to 75% of calcium fluoride or barium fluoride, 15 to 45% of uranium tetrafluoride, and from 10 to 20% of lithium fluoride or magnesium fluoride; the temperature of the electrolyte is between 1150 and 1175°C. (AEC)

Separation Processes

30491 (HW-SA-1936) THE SALT CYCLE PROCESS. G. E. Benedict, W. L. Lyon, L. K. Mudge, J. L. Swanson, and M. T. Walling, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Aug. 1960]. Contract AT(45-1)-1350. 13p.

The Salt Cycle Process is a nuclear fuel processing approach designed for application in compact facilities located at the reactor sites. Irradiated UO_2 fuels would be processed through a brief sequence of steps and partially purified UO_2 or UO_2-PuO_2 powders recovered, suitable for refabrication into fuel elements. The major steps of the process are the dissolution of uranium oxides in molten NaCl–KCl eutectic by chlorination to form soluble uranyl chloride and the reduction of uranyl chloride to UO_2, which separates as a solid. The preferred method of reduction is the electrolytic method, which yields UO_2 as a conveniently handled, adherent deposit on the cathode. Means are described for separation of Pu from U and for co-deposition of the two. Also included are discussions of the probable nature of the U and Pu species present in the molten salt, side reactions in which uranyl chloride may participate, and the influence of certain variables on the properties of the UO_2 produced. (auth)

30492 (HW-SA-1939) THE RECOVERY AND INDIVIDUAL ISOLATION OF MACROSCOPIC QUANTITIES OF CERIUM, STRONTIUM, AND TRIVALENT RARE EARTHS FROM PUREX-TYPE FISSION PRODUCT WASTE. L. A. Bray, R. L. Moore, H. H. Van Tuyl, and E. J. Wheelwright (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 17, 1960. Contract AT(45-1)-1350. 20p.

The rare earths are precipitated as the sodium double-sulfates and strontium is precipitated by using a lead sulfate carrier. Cerium and the trivalent rare earths are separated by precipitating cerium(IV) peroxyacetate from a hydrogen peroxide–acetate buffered solution. The peroxy–acetate process has the unique advantages, over conventional cerium-rare earth separations, of avoiding reagents corrosive to stainless steel and strong oxidants (which might volatilize ruthenium). Highly purified promethium is isolated from the trivalent rare earths by EDTA ion-exchange chromatography. (auth)

30493 (HW-SA-1963) RECOVERY OF NEPTUNIUM IN SOLVENT EXTRACTION PROCESSES. G. E. Benedict, T. R. McKenzie, and G. L. Richardson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 11, 1960. Contract AT(45-1)-1350. 16p.

Studies to investigate the feasibility of recovering Np in existing Hanford separation plants by the Purex and Redox processes are described. In the Purex process, nitrate ion in the presence of catalytic traces of nitrous acid can be used to oxidize Np to the extractable hexavalent state, and in the Redox process, a strong oxidant (dichromate) is already present so that it is only necessary to increase the acidity of the aqueous phase to effect the extraction of Np along with U and Pu. (J.R.D.)

30494 (HW-SA-2025) DIALKYL ETHERS AS SOLVENTS—STRUCTURE EFFECTS AND THE EXTRACTION OF ACTINIDES. L. L. Burger (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 31, 1960. Contract AT(45-1)-1350. 14p.

In investigations concerning the water content of dibutyl carbitol, pentaether, diethyl ether, and several ketones revealed that, although about 2 molecules of water accompany the uranyl nitrate molecule in solvent extraction, the amount is not linear with U concentration; it also varies with different solvents. Other results indicate that water does not accompany the U to the organic phase incidentally, but is a necessary part of the complex. The solubility of uranyl nitrate in the diethers appears to be about 1 uranyl nitrate molecule for 2 ether molecules. A different type complex exists with the +4 actinide nitrates. Np(IV) extracted from a nitric acid solution into the diethers showed the characteristic absorption peaks of $Np(NO_3)_6^{=}$. In the absence of HNO_3, Np(IV) did not extract; it thus appears that the +4 actinides extract as the H_2MX_6 complex. (J.R.D.)

30495 (IDO-14589) CHEMICAL PROCESSING TECHNOLOGY QUARTERLY PROGRESS REPORT, JANUARY–MARCH 1962. J. R. Bower, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). June 29, 1962. Contract AT(10-1)-205. 41p.

The processing of Al fuel, principally of the MTR-ETR type, is reported. Processing rate averaged 90% of flow sheet values for the entire operating period, and a U recovery of 99.85% was achieved. Aqueous Zr fuel processing studies continued with the objective of adapting the HF process to continuous dissolution-complexing in order to increase the capacity of the ICPP process while using as

much existing equipment as possible to minimize costs. Good results were indicated in a 190-hr run dissolving 2% U-Zr fuel in a Monel dissolver using 4.8M HF-0.03M HNO_3 dissolvent at 200°F; insoluble material did not accumulate in the dissolver, although a U-containing film was formed, apparently in small, equilibrium quantity. Shorter term continuous laboratory dissolutions indicated that 4.8M acid was preferable to 10M acid for the acid feed rate/fuel surface ratios proposed, resulting in dissolver products of greater stability and higher uranium content. Additional laboratory data are presented on UF_4 hydrate form and solubility, together with maximum dissolvable U compositions with Zircaloy under various flowsheet conditions. Processing of Al alloys containing high Si was found to present no unusual problems in laboratory studies. Siliceous residues resulting from dissolution of Al-U alloys containing 2% Si in HNO_3 contained no insoluble U, and the occluded U was readily removed by solvent extraction with TBP-Amsco, the normal process extractant. Studies of the electrolytic dissolution process were directed at corrosion measurement and prevention, development of analytical systems for process control, and testing of structural insulating materials for use in the process environment. A measurement of corrosion potential is shown to indicate the instantaneous corrosion rate of stainless steel process equipment containing electrolytic dissolver solutions; this measurement could determine the amount of cathodic protection that might be used to protect certain corrosion sensitive areas. An in-line process solution analyzer was developed and a prototype constructed and placed in use; by simultaneous measurement of electric conductance of two flowing stream samples (one, the original concentration, and the other, a fixed dilution), the concentrations of both dissolver acid and dissolved stainless steel components are determined. The Demonstrational Waste Calcination Facility was operated continuously for 250 hr, showing good mechanical operability of process equipment and close control of process conditions. Escape of solids past the calciner cyclone into the liquid scrubbing system continued to be the principal area of concern. Pilot plant calciner studies indicated the rate of solids carry-over from the cyclone was nearly constant, whether the bed was predominantly alpha or amorphous alumina, however, solids elutriation rate from the bed varied with alumina crystal form. In laboratory studies directed toward calcination of wastes from stainless steel processing, the nitrates of Fe, Ni, and Cr were found to decompose thermally at temperatures approximately the same as those used for aluminum nitrate calcination. Miscellaneous basic process studies reported include experimental verification of analog results on air pulsed extraction column operating characteristics, indication of a method of sampling individual aqueous or organic phases in an operating column, and further evidence of the effectiveness of the cascade control system on the thermosiphon product evaporator. Progress is reported on design of neutron poison plate structures for protection of vessels of unsafe geometrical configuration from criticality incidents in the presence of high concentrations of enriched U. (auth)

30496 (ORNL-2971(Vol.5)) BIBLIOGRAPHY ON NUCLEAR REACTOR FUEL REPROCESSING AND WASTE DISPOSAL. VOLUME 5. PLANTS AND EQUIPMENT. T. F. Connolly (Oak Ridge National Lab., Tenn.). Contract [W-7405-eng-26]. 203p.

Approximately 1136 references on plants and equipment used for the processing of nuclear reactor fuels and waste disposal are given to books, bibliographies, symposia, journals, and contractors' topical reports published from 1955 to the present. (P.C.H.)

30497 (ORNL-TM-157) CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, FEBRUARY 1962. M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath, and C. D. Watson (Oak Ridge National Lab., Tenn.). Aug. 23, 1962. Contract [W-7405-eng-26]. 47p.

In the operation of 6-in.-dia. foam-liquid columns, increase in either the liquid flow or foam flow caused increased channeling with increased HTU. Flooding values for the Immi mixer-settler were obtained using the amine extraction final cycle Pu flowsheet. Two tests of the addition of uranyl nitrate to a thoria sol were made, one of which gave a good product and the other a product which disintegrated during calcination. Material balances for 22 waste calcination runs are summarized. (auth)

30498 (AEC-tr-5327) EXTRACTION AS A MEANS OF RECOVERING URANIUM AND RARE METALS FROM WATER SOLUTIONS. B. N. Laskorin, E. A. Yakubovich, G. P. (V.) Zuev (Zuyev), V. G. Krasov, V. F. Smirnov (Snirnov), and V. E. Pivovarov. Translated for Argonne National Lab., Ill., from Atomnaya Energ., 12: 503-13(June 1962). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 23793.

30499 (AWRE-Trans-37) AMPHOTERIC CHARACTER OF ETHYLENEDIAMINETETRAACETIC ACID AND ITS EFFECT ON THE STABILITY OF METAL COMPLEXES. M. Beck and S. Goeroeg. Translated by S. L. Somerville (U.K.A.E.A. Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.) from Magyar Tudományos Akad. Kém. Tudományok Osztályának, Közleményei, 12: 265-77(1959). 21p.

Computations were made of dissociation constants applicable to the V and VI types of ions, H_6Y^{2+} and H_5Y^{+}, and, from results on the study of the solubility of EDTA in strongly acid solutions; conclusions regarding the behavior of the metal complexes of EDTA were made. The partial decomposition due to the influence of acid on the Fe(III) EDTA complex was studied. The solubility of EDTA diminished as pH diminished; it has a minimum at pH 1.8 and increases when the hydrogen ion concentration further increases. Solubility reached a maximum in about 2.5 mole/l perchloric acid, after which it rapidly dropped as concentration of the perchloric acid further increased. It was proved that the large discrepancy in published values of the stability constant of the FeY^{-} complex was due to disregard of the existence of the H_2Y^{2+} and H_3Y^{-} ions. By applying a new method of calculation based on measurement of the partial decomposition by acid influence of the FeY^{-}, the stability constants of FeY^{-}, FeHY, and FeH_2Y^{+} complexes were determined. (P.C.H.)

30500 THE PRODUCTION AND TESTING OF A HOMOGENEOUS POLYMERIC MEMBRANE HAVING COMPLEXING PROPERTIES. V. A. Kargin, A. A. Efendiev, E. P. Cherneva, and N. N. Tunitskii (Karpov Inst. of Physical Chemistry, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1307-8(June 1962). (In Russian)

Phosphorylated organic ion exchangers can selectively complex iron, thorium, uranium, and other elements. A phosphorylated organic ion exchanger was made by copolymerizing the diisobutyl ether of vinylphosphinic acid with acrylic acid. Two to four percent triallylcyanurate was used as a cross-linking agent. The organic ion exchanger is insoluble in water and in organic solvents. It is stable to acids and bases. The capacity of the ion-exchanger for the absorption of Fe^{3+} from a 0.1 N solution of $FeCl_3$ was found to be 6.4 mg-equivalents per gram after 2 hours contact time, 7.2 at 4 hours, 12.2 at 24

hours and 12.3 mg-equivalents per gram after 48 hours contact time. Equilibrium is established in 24 hours. The adsorbed Fe^{3+} is removed completely after 4 hours contact with 0.5 N HCl. (TTT)

30501 SOLVENT EXTRACTION STUDIES ON THE HYDROCHLORIC ACID-TETRAPHENYLARSONIUM CHLORIDE CHLOROFORM SYSTEM. Kaoru Ueno (Japan Atomic Energy Research Inst., Tokyo) and Chau-ting Chang. Nippon Genshiryoku Gakkaishi, 4: 457-62(July 1962). (In English)

A radiochemical study of the solvent-extraction behavior of more than fifty chemical elements in the hydrochloric acid–tetraphenylarsonium chloride–chloroform system is performed. The distribution ratios are determined for hydrochloric acid solutions of 0.5 to 12N. It is concluded that: cationic species in hydrochloric acid solution are not extractable; and anionic species in hydrochloric acid solution are readily extracted, but monovalent species are much more extractable than di- or trivalent species. (auth)

30502 CONCENTRATION OF INDIUM BY MELTING TECHNOLOGICAL POWDER IN TIN FACTORY. V. A. Moshkina, V. V. Pokrovskii, and D. I. Repkin. Tsvetnye Metally, 35: No. 4, 61-3(1962). (In Russian)

A specimen of filtered technological dust containing 0.137% In, 9.9% Su (soluble in HCl), 28.8% Su (insoluble in HCl), 2.17% Pb, and other metal admixtures was melted in a three-phase furnace at 1450 to 1500°C in order to concentrate the amount of In and reduce the amount of Sn. The product, containing 0.36% In, 16.50% Sn, 40.0% Zn, 0.96% Pb, and 0.45 Cd, was subjected to reducing roasting, sublimating 90 to 95% of the indium. (R.V.J.)

30503 EXTRACTION OF NIOBIUM AND TANTALUM N-BENZOYLPHENYLHYDROXYLAMINATES. I. P. Alimarin and O. M. Petrukhin. Zhur. Neorg. Khim., 7: 1191-6(May 1962). (In Russian)

The extraction of niobium and tantalum N-benzoylphenylhydroxylaminates from acidic media was investigated. A minimum on the Nb and Ta extraction graph is caused by a non-equilibrium extraction system. A method is suggested for evaluating polymerization and colloid formation in hydrous solutions. Niobium was extracted by N-benzoylphenylhydroxylaminate from 16 to 24 N aqueous solutions of H_2SO_4. (R.V.J.)

30504 EXTRACTION OF ZIRCONIUM IN PRESENCE OF HYDROFLUORIC ACID. S. S. Korovin, A. M. Reznik, and I. A. Apraksin (Moscow Inst. of Fine Chemical Tech.). Zhur. Neorg. Khim., 7: 1483-4(June 1962). (In Russian)

Extraction of Zr(0.54 mole/l) from nitric acid solutions in the presence of fluorine ions was studied. Small fluorine to zirconium ratios (0.5 : 1) increase the distribution coefficient, while a ratio of 1 : 1 exerts no distribution effects. (R.V.J.)

30505 SEMIWORKS-SCALE STRONTIUM-90 PURIFICATION USING D2EHPA EXTRACTION. C. R. Cooley and G. L. Richardson (General Electric Co., Richland, Wash.). Preprint Paper No. 15. New York, Engineers Joint Council, 1962. 32p. (HW-SA-2373)

Purification of nearly a megacurie of Sr^{90} was successfully accomplished in the contact-maintained Hot Semiworks at Hanford Atomic Products Operation. The process used an organic solution of D2EHPA (di-2-ethyl hexyl phosphoric acid) to extract Sr^{90} from an acetate-buffered, EDTA- or DTPA-complexed feed prepared from Purex process waste. The process and operating experience are described. (auth)

30506 REMOVAL OF CERTAIN FISSION PRODUCT METALS FROM LIQUID BISMUTH COMPOSITIONS. (to U. S. Atomic Energy Commission). British Patent 904,374 Aug. 29, 1962.

A method is given for the efficient and economical separation from liquid U–Bi alloys of fission products, particularly those forming chlorides less stable than UCl_3 and thus unaffected by the oxidizing fused salt extraction. The method comprises mixing the liquid alloy with 0.2 to 2.5% Zn at 400 to 500°C to form a homogeneous melt, allowing a solid phase containing the Zn and fission products to form, separating the solid phase from the alloy, and distilling the dissolved Zn from the alloy at 550 to 600°C. The effect of the method on the U content of the alloy is small. (D.L.C.)

30507 PROCESS FOR ISOLATING RADIO-ACTIVE IODINE 131. Wilhelmus Bernardus Huising, Herman Hendrik Philip Moeken, and Dirk Nonhebel (to North American Philips Co. Inc.). U. S. Patent 3,053,644. Sept. 11, 1962.

A simple method is given for separating I^{131} from neutron-irradiated tellurium dioxide powder. The method comprises suspending the powder in an aqueous solution of H_2SO_4 and H_2O_2, heating the suspension to boiling to cause distillation of I^{131}, and collecting the distillate in a dilute lye solution. (D.L.C.)

30508 PROCESS FOR RECOVERING URANIUM VALUES. Robert J. Teitel (to Dow Chemical Co.). U. S. Patent 3,053,650. Sept. 11, 1962.

A pyrometallurgical process is given for separating U values from alloys or compositions containing U and Al. The process comprises heating a mixture of the composition and Mg or Mg–Zn containing at least 20% Mg to form a precipitate of U–Al alloy in a Mg alloy melt, separating the precipitate from the melt, and treating the precipitate with Mg and/or Zn to remove the Al therefrom. Several examples of the application of the process to spent fuel alloys are given. (D.L.C.)

30509 PROCESS FOR SEPARATING RARE EARTHS AND YTTRIUM BY ION EXCHANGE. Pawel Krumholz, Rua Maestro Elias Lobo, and Kasimierz Josef Bril. U. S. Patent 3,054,655. Sept. 18, 1962.

A process for separating rare earths and yttrium by ion exchange is given which uses a second ion exchange bed in the zinc or cadmium state rather than the copper state. The process comprises adsorbing the rare earth mixture on an ion exchange bed and eluting the bed with ethylenediamine tetraacetic acid through a second resin bed in the zinc or cadmium form. The resin for both beds preferably is a sulfonated polystyrene–divinylbenzene copolymer of low crosslinkage (around 4%). Alternatively, a mixture of rare earths and a small amount of zinc or cadmium may be charged on one resin bed and then eluted. The advantages of the process are that separations are good for the rare earths eluted together with the zinc or cadmium as well as these eluted afterwards, and that the zinc or cadmium complexes are easily decomposed by acidification to recover the eluant. (D.L.C.)

30510 METHOD OF SEPARATING NON-SURFACE ACTIVE IONIC MATERIALS FROM SOLUTION. Elmer L. Gaden, Jr. and Robert W. Schnepf (to Radiation Applications, Inc.). U. S. Patent 3,054,747. Sept. 18, 1962.

A method for separating ionic materials from aqueous solutions is given which uses foam separation. The method comprises combining the solution with a foaming agent which reacts with the ionic material to produce a soluble surface-active complex, and separating the rich surface layer from the solution. Various types of foaming agents may be used, and examples of the method are given for the removal of Sr^{3+} ions from solutions. (D.L.C.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

30511 (DP-764) A VIBRATORY POLISHER FOR REMOTE METALLOGRAPHY. Carlton K. Nicholson (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.) and Clifton L. Williamson (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.). Aug. 1962. Contract AT(07-2)-1. 9p.

A vibratory polishing machine that is commercially available was adapted to polish irradiated metallographic specimens in a hot cell. The modified polisher is easy to operate and maintain remotely, and provides for both chemical attack and abrasive polishing. (auth)

30512 (DP-769) A MACHINE FOR CUTTING RADIOACTIVE MATERIALS. Richard D. Kelsch (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Aug. 1962. Contract AT(07-2)-1. 10p.

A machine was developed for cutting radioactive materials to various sizes and shapes in a shielded area. All cutting is done by an abrasive wheel; separate cutting and clamping devices are not required. The machine can be installed and maintained remotely and all in-cell operations are performed with master-slave manipulators. (auth)

30513 (HW-SA-2081) PHOTOMICROGRAPHY—A BIG BUSINESS ON A SMALL SCALE. T. K. Bierlein, B. Mastel, and E. C. Watts (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [nd]. Contract AT(45-1)-1350. 11p.

Applications of photomicrography in studies on radiation damage to crystalline material are discussed. Equipment and procedures for the preparation of photomicrograms are described. (C.H.)

30514 (KAPL-M-EC-20) BMS—STRESS ANALYSIS OF CYLINDRICAL SHELLS. D. G. Dight and R. F. Wojcieszak (Knolls Atomic Power Lab., Schenectady, N. Y.). June 1, 1962. Contract W-31-109-eng-52. 54p.

BMS is a digital computer program which uses finite difference procedures to calculate deflections, slopes, and stresses along the length of a cylindrical shell, cone (whose apex angle is relatively small), or beam on elastic foundation resulting from any type of axi-symmetric loading. It also includes axial temperature distributions. It is possible to analyze a shell with variable thickness, radius, and modulus of elasticity whose end conditions are fixed, free, pinned or attached to another elastic structure. The program running time is dependent on the number of nodes. A 50 node problem will run in less than 1 minute. The Philco-2000 computer is used. (auth)

30515 (TID-4100(1st Rev. Index 2)) ENGINEERING MATERIALS LIST. Cumulative Index through Supplement 12. Richard E. C. Duthie, ed. (Division of Technical Information Extension, AEC). Sept. 1961. 149p.

Included are equipment lists under computers, engineering equipment (miscellaneous), hot laboratory equipment, instruments, metallurgical equipment and processes, nuclear radiation instruments, nuclear reactors and reactor facilities, particle accelerators, radiation equipment (biological), shielded containers, thermonuclear devices, and waste disposal equipment. The list supersedes all previous engineering materials indexes. (J.R.D.)

30516 (UCLA-464) AN IMPROVED SELF-STIMULATOR FOR ANIMAL EXPERIMENTS. R. W. Farmer, O. Reiner, Jr., and N. Abell, Jr. (California. Univ., Los Angeles. School of Medicine). Nov. 10, 1960. Contract AT(04-1)-Gen-12. 17p.

A self-stimulator for animal experiments was designed and a pilot model was built. Transistor circuits are incorporated in the unit to give optimum operation and an improved connector to connect the cable to the brain electrodes is also included. (auth)

30517 BEARING AND LUBRICANT REQUIREMENTS FOR SOME AEROSPACE PROJECTS: DISCUSSION AND PRELIMINARY INVESTIGATION. R. H. Larson and A. G. Piken (Bendix Research Labs., Southfield, Mich.). ASLE (Am. Soc. Lubrication Engrs.) Trans., 5: 1-7(Apr. 1962).

Some of the pressing bearing and lubrication problems which confront the aero-space industry today are illustrated. Specific requirements of bearings and lubricants for nuclear engine controls and a hot gas flight stabilization system are given. The results of a lubricant survey are discussed, and the preliminary test results obtained in a 600°F lubricant evaluation program are presented. A brief discussion of the merits and limitations of gas-lubricated bearings in extreme environments is included. The concluding remarks emphasize the need for increased bearing and lubricant research. (auth)

30518 WEAR CHARACTERISTICS IN NONMETALLIC MATERIALS. W. A. Glaeser (Battelle Memorial Inst., Columbus, Ohio). Electro-Technol. (New York), Apr. 1962. 6p.

The wear properties, tensile properties, wear-resistance applications, and wear-reducing lubricants for various types of rubber, ceramics, cermets, jewels, plastics, carbon, and graphite are evaluated. (T.F.H.)

30519 DESCRIPTION OF A HOT SHIELDED CELL FOR THE ANALYTICAL CHEMISTRY OF RADIOACTIVE MATERIALS. G. Arcelli, U. Rosa, and G. A. Scassellati (SORIN, Centro Ricerche Nucleari, Saluggia, Italy). Energia nucleare (Milan), 9: 472-80(Aug. 1962). (In Italian)

A description is given of the criteria followed in the design, construction, and assembling of a shielded hot cell intended for analytical chemistry work on radioactive substances, β and γ emitters, and particularly on fission products. The external and the internal structure, the shielding and the handling devices, and all the facilities of the cell are described, with special regard to the ventilation and the radioactive waste collection systems. Particular care has been devoted to the lay-out and the accommodation of the inside apparatus, intended to fulfill, besides the common operations of an analytical chemistry laboratory, also the application of more complex techniques as electroanalytical procedures. (auth)

30520 DESIGN OF PRESSURE VESSELS FOR LOW-CYCLE FATIGUE. B. F. Langer (Westinghouse Electric Corp., Pittsburgh). J. Basic Eng., 84: 389-402(Sept. 1962).

Methods are described for constructing a fatigue curve based on strain-fatigue data for use in pressure vessel design. When this curve is used, the same fatigue strength-reduction factor should be used for low-cycle as for high-cycle conditions. When evaluating the effects of combined mean and alternating stress, the fatigue strength-reduction factor should be applied to both the mean and the alternating component, but then account must be taken of the reduction in mean stress which can be produced by yielding. The

complete fatigue evaluation of a pressure vessel can be a major task for the designer, but it can be omitted, or at least drastically reduced, if certain requirements can be met regarding design details, inspection, and magnitude of transients. Although the emphasis is on pressure vessel design, the same principles could be applied to any structure made of ductile metal and subjected to limited numbers of load cycles. (auth)

30521 MAGNETOHYDRODYNAMIC PRESSURIZATION OF LIQUID METAL BEARINGS. R. A. Elco and W. F. Hughes (Carnegie Inst. of Tech., Pittsburgh). Wear, 5: 198-212(May-June 1962). (In English)

The concept of the magnetohydrodynamic bearing is introduced and two types of bearings are analyzed. First a hydrostatic thrust bearing with an axial current-induced pinch is considered. It is shown that the load capacity can be increased and with no flow or external pressurization a load can be sustained because of the "pinch" effect. However, the magnitude of this pressurization is very small for physically practical values of current. The second bearing considered is the infinite inclined slider with an applied magnetic field parallel to the bearing surface and perpendicular to the direction of motion of the slider. For this type of bearing the pressure distribution, load capacity, and electrical characteristics are calculated and it is shown that useful electromagnetic pressurization can be obtained with reasonable values of magnetic field strength and current. (auth)

30522 ON THE LOAD CAPACITY OF THE HYDROMAGNETICALLY LUBRICATED SLIDER BEARING. J. F. Osterle and F. J. Young (Carnegie Inst. of Tech., Pittsburgh). Wear, 5: 227-34(May-June 1962). (In English)

The load capacity of liquid metal lubricated slider bearings subject to an applied magnetic field transverse to the film is investigated. The optimum profile is determined and found to be the Rayleigh step form with the riser location and step height ratio dependent on the strength of the magnetic field. Load capacity is favored by large magnetic fields, small film thicknesses, and electrically insulating bearing surfaces. Only modest load increases can be obtained from conventional magnets of reasonable size. Substantial load increases could be accomplished by the recently developed superconducting electromagnets. (auth)

30523 COORDINATE REMOTE CONTROL EQUIPMENT FOR HANDLING RADIOACTIVE ISOTOPES. M. A. Veksler. Zavodskaya Lab., 28: 995-8(1962). (In Russian)

The design, specifications, and performance of an electric remote-control manipulator for handling radioactive materials are described. The manipulator and auxiliary devices are placed in a $5 \times 0.8 \times 2.75$ m casing with a 20-mm lead shielding; the control station is ~4 m distant. The vacuum, compressed air, and water systems are also described. (R.V.J.)

30524 IMPROVEMENTS IN GAMMA IRRADIATION APPARATUS. (to Babcock and Wilcox Ltd.). British Patent 903,760. Aug. 22, 1962.

A gamma irradiation apparatus is designed which moves a material through a reactor to be activated and thence to a chamber containing a second material to be irradiated with gamma radiation from the first material. The first material is in the form of spherical bodies moved by a screw conveyor, whose rate of operation controls the amount of radiation received by the bodies. The bodies may be rolled quickly into the irradiation chamber in the case where the activated radioactivity is of short half life. (D.L.C.)

30525 IMPROVEMENTS IN PRESSURE-TIGHT JOINTS BETWEEN TUBULAR ELEMENTS. Thomas Basil Webb (to Babcock and Wilcox Ltd.). British Patent 903,784. Aug. 22, 1962.

A modification of the pressure-tight joint described in British Patent 733,647 may be used for joining a steel tubular element to a tubular element of a non-ferrous metal with a low neutron capture cross section. (D.L.C.)

30526 APPARATUS FOR CATHODIC ETCHING OBJECTS. (to Nuclear Materials and Equipment Corp.). British Patent 903,790. Aug. 22, 1962.

A remote-control apparatus is designed for etching radioactive metals or alloys by positive ion sputtering. A bellows is used to establish electrical and thermal contact. (D.L.C.)

30527 METHOD AND MEANS FOR STARTING OF SELF-SUSTAINING CHEMICAL REACTIONS. Maurice Delange and Henri Huet (to Commissariat á l'Énergie Atomique). British Patent 903,803. Aug. 22, 1962.

A method and device are described for the remote starting of exothermic chemical reaction of a mixture in a closed vessel. The device comprises a cartridge mounted on a wall of the vessel and containing a percussion cap and a portion of the mixture mixed with a little peroxide. In operation, the percussion cap is detonated to ignite the portion of the mixture and to project the same into the vessel. The method is particularly suitable for starting the reaction of extracting metallic U from UF_4. (D.L.C.)

30528 SELF-PROPELLED LOAD CARRYING TRUCK. (to Commissariat á l'Énergie Atomique). British Patent 904,148. Aug. 22, 1962.

A self-propelled truck is designed for traveling on a circular track around a reactor and on a straight track perpendicular to the circular track and extending radially from the reactor. The truck has two converging axles with wheels for running on circular tracks and two parallel axles for running on radial tracks, and a motor is provided for each axle set. The truck also has jacks for raising or lowering one axle set relative to the other and means for detecting a track perpendicular to the track on which the truck is moving and for positioning the truck for transfer to the other track. (D.L.C.)

30529 IMPROVEMENTS IN AND RELATING TO DRY LUBRICATION. Kenneth Frederick Phillips and William Rupert Brooke Elstow (to English Electric Co. Ltd.). British Patent 904,214. Aug. 22, 1962.

A dry lubricant for use at high temperatures comprises lead sulfide and colloidal graphite in a weight ratio of 3.7 and applied by brushing or spraying to a thickness of 10^{-4} in. on bearing surfaces. Films of this composition were found to operate well in dry CO_2 and vacuum continuously up to 200°C and for limited periods up to 400°C, and in dry air for limited periods up to 350°C. (D.L.C.)

30530 ELECTRICAL CONNECTOR. Harry Charles Stubbings (to United Kingdom Atomic Energy Authority). British Patent 904,827. Aug. 29, 1962.

A coaxial cable connector is designed which is capable of passing very heavy pulses on the order of 90 to 100 kv and 200 kamp. The connector comprises a plug member with a tapered central contact pin and a socket member with a brass sleeve. Connection is made by an interference fit. (D.L.C.)

30531 APPARATUS FOR MANIPULATING RADIOACTIVE MATERIAL. Robert J. Prest (to Technical Operations Inc.). British Patent 904,988. Sept. 5, 1962.

An apparatus is designed for transferring a capsule of radioactive material between two shielding devices. The apparatus comprises tubular guide means between the two shielding devices and means for pushing or pulling the cap-

sule through the guide means. The operation of the apparatus in exchanging a new capsule for an old one is described. (D.L.C.)

30532 IMPROVEMENTS IN WELDING PROCESS AND EQUIPMENT. (to Commissariat á l'Énergie Atomique). British Patent 905,387. Sept. 5, 1962.

Heating equipment is designed for heating both opposite faces of work adjacent the weld before, during, and after a welding operation with minimum power consumption and heat dissipation into the surrounding area. The equipment comprises a set of similar pad elements with electric heater means and has means for supporting the pad elements over a metal sheet adjacent a weld. (D.L.C.)

30533 INTENSE ENERGETIC GAS DISCHARGE. (to U. S. Atomic Energy Commission). British Patent 905,428. Sept. 5, 1962.

A device is designed for producing an energetic gas-fed arc discharge for dissociating a large percentage of molecular ions passed therethrough without large Bremsstrahlung energy losses. The device comprises an elongated hollow cathode and an anode, means for evacuating the region between the electrodes, means for establishing a magnetic field between the electrodes, means for feeding gas to the cathode interior, means for inititating an arc discharge, and means for cooling the electrodes. The device may be used in a thermonuclear reactor. (D.L.C.)

30534 IMPROVEMENTS IN OR RELATING TO THE REMOVAL OF SHEATHS FROM NUCLEAR REACTOR FUEL ELEMENTS. Horace Frank Parker, Leslie James Seddon, and Dennis Moorhouse (to United Kingdom Atomic Energy Authority). British Patent 905,523. Sept. 12, 1962.

An apparatus is designed for removing the sheaths from irradiated fuel elements. The apparatus comprises three cutter wheels for cutting into the sheath along its length for dividing the sheath into longitudinal portions, and a plough for operating in these cuts to peel the portions from the fuel member. The apparatus is housed in a tank for operating under water, which is advantageous where Na or Na–K alloy is used as heat transfer medium between the fuel element and its sheath, as the alkali metal comes into contact with water very gradually and reacts without violence. (D.L.C.)

30535 IMPROVEMENTS IN OR RELATING TO TELEVISION CAMERAS. Ian Morley Waters and Peter Barratt (to Pye Ltd.). British Patent 906,406. Sept. 19, 1962.

The requirements for a television camera which is to be used in a gas-cooled reactor during operation (10^{13} n/cm^2/sec, 300°C, 250 psi) are discussed in some detail. The materials most often used are aluminum, ceramics, tantalum, stabilized glass, quartz, and synthetic sapphire. A camera unit is designed which includes a lens, a television pickup tube, and a head amplifier for the pickup tube. The rest of the camera is located outside the reactor. (D.L.C.)

30536 THERMOELECTRIC DEVICES AND THERMOELEMENTS. Russell E. Fredrick and Robert W. Fritts (to Minnesota Mining and Mfg. Co.). U. S. Patent 3,051,767. Aug. 28, 1962.

A thermoelectric generator is designed for efficient operation at high hot junction temperatures (1500°F) and low cold junction temperatures (100°F). The generator comprises one N-type thermoelement and one P-type thermoelement, and each thermoelement is formed of a plurality of different materials, each of which has a superior figure of merit at the operating temperatures encountered by the respective portion. (D.L.C.)

30537 APPARATUS FOR SHEARING TUBULAR JACKETS. John P. Simon (to U. S. Atomic Energy Commission). U. S. Patent 3,052,142. Sept. 4, 1962.

A machine is designed for removing the jacket from the core of a used rod-like fuel element by shearing the jacket into a spiral ribbon. Three skewed rolls move the fuel element axially and rotatively, and a tool cooperates with one of the rolls to carry out the shearing action. (AEC)

30538 DEVICES FOR PROTECTION AGAINST IONIZING RADIATION AND CONTAMINATION BY HARMFUL DUSTS, FOR APPARATUS FOR OBSERVING THE INTERIOR OF SEALED CHAMBERS. Serge René Clavé (to Commissariat a l'Energie Atomique). U. S. Patent 3,052,151. Sept. 4, 1962.

An optical apparatus is designed for observing the interior of chambers containing radioactive material. The apparatus comprises a tube mountable in an opening in the chamber wall and serving as a housing for a series of radiation screens with non-aligned openings, prism means in the tube for guiding light through the non-aligned openings, bellows means for covering the tube as it is withdrawn from the opening, and sealing means for closing the bellows end after the tube is entirely withdrawn into the bellows. The optical structure of the apparatus is of standard type, e.g., azimuth-type periscopes. (D.L.C.)

30539 LIQUID CYCLONE CONTACTOR. M. E. Whatley and W. M. Woods (to U. S. Atomic Energy Commission). U. S. Patent 3,052,361. Sept. 4, 1962.

This invention relates to liquid-liquid extraction systems. The invention, an improved hydroclone system, comprises a series of serially connected, axially aligned hydroclones, each of which is provided with an axially aligned overflow chamber. The chambers are so arranged that rotational motion of a fluid being passed through the system is not lost in passing from chamber to chamber; consequently, this system is highly efficient in contacting and separating two immiscible liquids. (AEC)

30540 METHOD OF LUBRICATING WITH A RADIATION-RESISTANT UREIDO COMPOUND THICKENED LUBRICATING OIL. Thornton P. Traise (Standard Oil Company). U. S. Patent 3,052,633. Sept. 4, 1962.

A grease is described for applications requiring stability in the presence of 10^4 to 10^{10} r of high-energy ionizing radiations, particularly slow neutrons. The grease comprises a lubricant base fluid thickened to grease consistency with a ureido compound of the formula RNHCONHR'NHCONHR'', where R and R'' are abietyl radicals and R' is an alkylene radical or an arylene radical. The ureido compound can be prepared by heating a mixture of an abietyl amine and a polyisocyanate. Lubricants which may be thickened in this way include silicone polymers, mineral oils, hydrocarbons, fluorinated compounds, etc. (D.L.C.)

30541 RADIATION PROTECTION GARMENT. George Hollands (Bar-Ray Products, Inc.). U. S. Patent 3,052,799. Sept. 4, 1962.

A radiation protection apron is designed which is flexible, comfortable, and resistant to wear. The apron is made out of lead-impregnated plastic sheeting in double layers. (D.L.C.)

30542 SOLAR POWER SOURCE. Mary Beth Stearns (to General Dynamics Corp.). U. S. Patent 3,053,923. Sept. 11, 1962.

An inexpensive solar power source is designed which has a low weight-to-output power ratio. The source includes a first surface for absorbing solar energy and converting it to thermal energy, a second surface for radiating energy, and at least one pair of dissimilar thermoelectric elements (n- and p-type) connected between the two surfaces. A plurality of junctions of thermoelectric element pairs may be connected in series to increase the voltage output. (D.L.C.)

30543 ATOMIC BATTERY AND TEST INSTRUMENT. Nicholas Viszlocky. U. S. Patent 3,053,927. Sept. 11, 1962.

A portable nuclear battery is designed which can be adjusted to vary the output. The battery comprises a Sr^{90}-activated phosphor light source and photocells housed in a shielding structure. The output may be varied by rotating elements between the light source and the photocells. (D.L.C.)

30544 APPARATUS FOR ELECTRON BEAM HEATING CONTROL. William H. Jones and Judson B. Reece (to U. S. Atomic Energy Commission). U. S. Patent 3,054,896. Sept. 18, 1962.

An improved electron beam welding or melting apparatus is designed which utilizes a high voltage rectifier operating below its temperature saturation region to decrease variations in electron beam current which normally result from the gas generated in such apparatus. (AEC)

30545 PROCESS AND APPARATUS FOR CONVERTING THERMAL ENERGY INTO ELECTRICAL ENERGY. George N. Hatsopoulos and Joseph Kaye (to Thermo Electron Engineering Corp.). U. S. Patent 3,054,914. Sept. 18, 1962.

A thermionic device is designed for operation at very high temperatures. In the device, one of two spaced electron-emissive surfaces is heated to 2000 to 3000°F, while the other surface is maintained at a temperature 400 to 500°F below that of the hot surface. The hot surface should have a work function of ≤ 15 kT and should be spaced from the other surface by less than 0.002 inch. (D.L.C.)

30546 ARRANGEMENT FOR THE PULSE MODULATION OF A BEAM OF CHARGED PARTICLES ACCELERATED BY HIGH POTENTIALS. Wolfgang Opitz (to Carl Zeiss). U. S. Patent 3,054,962. Sept. 18, 1962.

An arrangement is designed for the pulse modulation of charged-particle beams in a beam generating system with a grounded anode. In this arrangement, the control electrode of the system is connected to the secondary winding of a wide-band isolating transformer, the primary winding being connected to a pulse generator at ground potential. (D.L.C.)

30547 ELECTROSTRICTION VALVE. Dean O. Kippenhan (to U. S. Atomic Energy Commission). U. S. Patent 3,055,631. Sept. 25, 1962.

An accurately controlled, pulse gas valve is designed capable of delivering output pulses which vary in length from one-tenth millisecond to one second or more, repeated at intervals of a few milliseconds or more. The pulsed gas valve comprises a column formed of barium titanate discs mounted in stacked relation and electrically connected in parallel, with means for applying voltage across the discs to cause them to expand and effect a mechanical elongation axially of the column. The column is mounted within an enclosure having an inlet port and an outlet port with an internal seat in communication with the outlet port, such that a plug secured to the end of the column will engage the seat of the outlet port to close the outlet port in response to the application of voltage is regulated by a conventional electronic timing circuit connected to the column. (AEC)

30548 MASS SEPARATION OF HIGH ENERGY PARTICLES. L. Marshall (to U. S. Atomic Energy Commission). U. S. Patent 3,056,023. Sept. 25, 1962.

An apparatus and method are described for separating charged, high energy particles of equal momentum forming a beam where the particles differ slightly in masses. Magnetic lenses are utilized to focus the beam and maintain that condition while electrostatic fields located between magnetic lenses are utilized to cause transverse separation of the particles into two beams separated by a sufficient amount to permit an aperture to block one beam. (AEC)

30549 ELECTRICAL COIL STRUCTURE. William R. Baker and A. Hartwig (to U. S. Atomic Energy Commission). U. S. Patent 3,056,071. Sept. 25, 1962.

A compactly wound electrical coil is designed for carrying intense pulsed currents such as are characteristic of controlled thermonuclear reaction devices. A flat strip of conductor is tightly wound in a spiral with a matching flat strip of insulator. To provide for a high fluid coolant flow through the coil with minimum pumping pressure, a surface of the conductor is scored with parallel transverse grooves which form short longitudinal coolant passages when the conductor is wound in the spiral configuration. Owing to this construction, the coil is extremely resistant to thermal and magnetic shock from sudden high currents. (AEC)

Heat Transfer and Fluid Flow

30550 (LADC-5288) THE PARTICLE-IN-CELL METHOD FOR NUMERICAL SOLUTION OF PROBLEMS IN FLUID DYNAMICS. Francis H. Harlow (Los Alamos Scientific Lab., N. Mex.). Mar. 1962. Contract [W-7405-eng-36]. 39p.

The particle-in-cell method is a procedure to be used on high-speed computer for studies of the dynamics of compressible fluids undergoing large distortions. The technique is described for calculation of the dynamics of two fluids confined in a two-dimensional rectangular box. Techniques are also discussed for the extension to numerous other types of problems. The properties, limitations, and uses of the method are discussed. (auth)

30551 (MIT-AL-TR-23) MEASUREMENTS OF HELICAL FLOW OF A STRONG ELECTROLYTE WITH AND WITHOUT A TRANSVERSE MAGNETIC FIELD. Laurence R. Boedeker and Eugene E. Covert (Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.). Apr. 1962. Contract AF49(638)-900. 82p. (AFOSR-2806)

An experiment to measure the MHD effects in an electrolyte is described. The configuration investigated was the slow flow of hydrochloric acid in a helix. At very low Reynolds numbers a transverse magnetic field was found to retard the flow in agreement with existing theory and with existing experimental results obtained using mercury. At higher Reynolds numbers where secondary flow in a helix becomes important the transverse magnetic field was found to reduce this secondary flow. A primary conclusion of this study was that the one fluid model of incompressible MHD flow is valid in the absence of large gradients. (auth)

30552 (NAA-SR-7325) SODIUM CONDENSING HEAT TRANSFER. AN EXPERIMENTAL STUDY OF ONE ASPECT OF SODIUM COOLED REACTOR SAFETY. G. L. Reed and R. C. Noyes (Atomics International. Div. of North American Aviation Inc., Canoga Park, Calif.). Dec. 15, 1961. Contract AT(11-1)-Gen-8. 55p.

A problem of emergency heat removal in Na-cooled reactors is concerned with the condensing of Na vapors that might be generated as a result of a hypothetical loss-of-heat-sink accident. An evaluation, in which the Na vapor condensing in the restricted region below the loading face shield of the Hallam Nuclear Power Facility was made, to determine heat removal capability. Experimental determinations of condensing heat transfer rates in a model of this region were made. The primary resist-

ance to heat transfer was found to be noncondensable gases present in the system. The gas (usually He) would be present because of its normal use as a cover gas in the core tank. A theoretical equation based on gaseous diffusion was derived, and the heat transfer rate is predictable provided the quantity of noncondensable gas is known. Further experiments were used to study the venting behavior of the gas space below the HNPF loading face shield during simulated accident conditions. These experiments provide information required to predict the quantity of noncondensable gas left in the system after a postulated accident and to predict associated heat transfer rates. Two venting methods were studied to determine the most efficient emergency venting procedure. It was found that if the region immediately below the top shield is vented, sufficient heat removal capability exists to condense all Na vapor that could be generated by afterglow heat. This would assure safety of the system by eliminating the possibility of any pressure buildup as a result of the postulated accident. (auth)

30553 (TID-16496) EXPERIMENTAL DETERMINATION OF AIR-WATER FLOW CHARACTERISTICS IN THE VENT TUBE. Bimonthly Report No. 13, June 1 to July 31, 1962. H. S. Isbin (Minnesota. Univ., Minneapolis). Aug. 11, 1962. Contract [AT(11-1)-926]. 6p.

Preliminary data were obtained in a program to determine the air-water flow characteristics in a vent tube. Samples of reduced data are included. Test equipment was set up for a study of two-phase flow through an aperture. Other studies in progress include those concerning estimation of heat transfer rates from superheated liquid films, mechanisms for burnout, temperature distributions in superheated liquid jets, and two-phase flow models. (J.R.D.)

30554 (TID-16539) HYDRODYNAMIC INSTABILITY AND THE CRITICAL HEAT FLUX OCCURRENCE IN FORCED CONVECTION VERTICAL BOILING CHANNELS. R. J. Weatherhead (Argonne National Lab., Ill.). Apr. 10, 1962. Contract [W-31-109-eng-38]. 28p. (UAC-6467)

An analysis of the relations between hydrodynamic instability and the critical heat flux in water cooling systems is presented. It is concluded that hydrodynamic instability results from slug flow, which is precipitated in the bubble flow regime by coalescence of flow-stream bubbles to form vapor slugs. At constant pressure and rate of bubble generation, the initiation of slug flow is directly dependent on the local steam quality and inversely dependent on the mass velocity. Once initiated, the degree of hydrodynamic instability is dependent on the length of channel in the slug flow regime; this in turn is dependent on both the inlet subcooling and the L/D ratio. The critical heat flux occurrence is directly dependent on the degree of hydrodynamic instability, the significant variables being system pressure, local steam quality, mass velocity, inlet subcooling, and L/D ratio. (J.R.D.)

30555 (UCRL-6072) A STUDY OF HEAT AND MASS TRANSFER TO UNINSULATED LIQUID OXYGEN CONTAINERS. David C. Holten (California. Univ., Livermore. Lawrence Radiation Lab.). July 20, 1960. Contract W-7405-eng-48. 18p.

Heat transfer associated with uninsulated metal containers of liquid O_2 is examined. It is noted that if such systems are in air, a non-condensable atmospheric film which surrounds the system acts as a barrier, through which water diffuses to reach the container wall. The controlling mechanism for heat transfer in this type of system is the outer boundary layer of air. Other conclusions resulting from the study are included along with recommendations for further investigations. (J.R.D.)

30556 (UCRL-6256) AERODYNAMIC TURBULENT SKIN FRICTION. Stirling A. Colgate (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 8, 1961. Contract W-7405-eng-48. 18p.

Aerodynamic turbulent skin friction was derived on a deductive basis starting with the concept of particle mean free paths. It is shown that for turbulence to exist the thickness of the laminar sublayer must equal or exceed about 34 $\lambda(c/u_{min})$, where λ is collision mean free path, c is local sound speed, and u_{min} is surface velocity of laminar sublayer. The concept of maximum momentum transport leads to the requirement of persistence of the maximum-angular-momentum vortex, which in turn results in the well-known logarithmic velocity profile. The continuity of logarithmic velocity profile stress and laminar sublayer stress leads directly to a turbulent boundary layer velocity distribution in agreement with experiment. (auth)

30557 (UCRL-6267) NUMERICAL SOLUTION OF THE ONE-DIMENSIONAL LAGRANGIAN HYDRODYNAMIC EQUATIONS. John G. Trulio and Kenneth R. Trigger (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 1961. Contract W-7405-eng-48. 95p.

It is shown that on non-shock regions the difference equations of von Neumann and Richtmyer for one-dimensional fluid flow provide a good analog of the total energy density which is exactly conserved, if a uniform space-time mesh is used. Implicit and explicit modifications of these equations are developed which exactly conserve analogs of energy, mass, momentum, and volume on both shock and nonshock regions, and for an arbitrary space-time mesh. The equations are generalized to describe one-dimensional cylindrical and spherical flow, again satisfying exact conservation theorems. Difference equations are also presented for calculating the motion of interfaces and free surfaces. These equations maintain the conservation properties of the interior difference equations, even in collision and cavitation processes. Lagrangian coordinates are used throughout. (auth)

30558 (UCRL-6411) TEMPERATURE DISTRIBUTION IN A THIN-WALLED COMBUSTION CHAMBER. Saul B. Gorski (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 7, 1961. Contract W-7405-eng-48. 16p.

An equation for steady-state temperature distribution is given for a thin-walled circular duct with airflow through and over it and heat addition over the aft inside half. An example problem utilizing typical values of system parameters is worked out in detail and the results are discussed. (auth)

30559 (UCRL-9574) EFFECTS OF A MAGNETIC FIELD ON NATURAL CONVECTION IN A TOROIDAL CHANNEL. Paul Concus (California. Univ., Berkeley. Lawrence Radiation Lab.). Feb. 1961. Contract W-7405-eng-48. 37p.

The problem of the natural convection of an electrically and thermally conducting fluid within a long, narrow, vertical toroidal channel centered in a large block of an electrically and thermally conducting solid was analyzed. A uniform horizontal magnetic field is applied to the fluid, and the bottom of the solid block is maintained at a higher fixed temperature than the top. The laminar steady-state single-cell convective motion of the fluid is considered and an approximate solution is found for the heat transfer rate between the bottom and top surfaces of the block in the limiting cases of small and large Hartmann number. A nu-

merical example is given for liquid sodium in which the application of a magnetic field of a few hundred gauss is shown to significantly reduce the rate of heat transfer. (auth)

30560 (CEA-tr-R-1573) V. CALCULS THERMIQUES ET MÉCANIQUES DES ÉCHANGEURS DE CHALEUR FONCTIONNANT À TRÉS BASSES TEMPÉRATURES. (Thermal and Mechanical Calculations of Heat Exchangers Operating at Very Low Temperatures). Ya. (Ia.) S. Gersh. Translated into French from Chap. V. of "Technique of Low Temperatures." Moscow, 1960. 25p.

Thermal and mechanical calculations for heat exchangers operating at very low temperatures are presented. The methods are based on temperature differences of the gases and graphical integration. (N.W.R.)

30561 (NP-tr-917) HANDBOOK ON HEAT TRANSFER. S. S. Kutateladze and V. M. Borishanskii (Borishanskiy). Translation of "Spravochnik po Teploperedache" (a publication of State Publishing House of Power Engineering, Moscow, 1958). 526p.

The basic principles of heat-transfer theory, heat conduction, convection, radiation, and calculations for heat exchangers are discussed. Topics covered include: basic concepts and equations, similarity of heat and hydrodynamic processes, steady heat flow in solid bodies, unsteady-state heat conduction in solids, basic equations of convection, turbulence, heat transfer in tubes and ducts during steady flow of incompressible fluid, heat transfer in the external flow of an incompressible fluid past bodies, heat transfer in gas flowing with great velocities, heat transfer in free convection, heat transfer in vapor condensation, heat transfer during boiling, heat transfer in melting and solidification, basic laws of heat radiation, radiative heat exchange in absorbing medium, fundamentals of heat calculation of exchangers, and hydraulic calculation of heat exchangers. (M.C.G.)

30562 THE EFFECT OF A LOCAL INCREASE IN HEAT FLUX ALONG A CHANNEL ON THE BURN-OUT HEAT FLUX. M. A. Styrikovich, Z. L. Miropol'skii, and V. K. Eva (Krzhizhanovskii Inst. of Power Engineering, USSR). Doklady Akad. Nauk S.S.S.R., 145: 93-6(July 1, 1962). (In Russian)

Heat transfer experiments were run on a vertical section of 18Cr9Ni stainless steel with an internal diameter of 8 mm. Most experiments were made with creation of a "hot spot" on the upper exit end of the tube. The ratio of heat flux at the "hot spot" to heat flux over the rest of the tube was varied from 1.35 to 2. The experiments were carried out at a pressure of 100 atms with mass flows of 2000, 850, and 400 kg/m^2-sec. The relative enthalpy of the heat transfer medium at the exit varied from 0.2 to 1.0. The tube wall was heated by alternating current, and the burn-out flux was determined from the sharp jump in wall temperature as measured by a thermocouple. The critical heat flux q_{cr} depended significantly on the length of the hot spot. The value of the critical heat flux q_{cr} was greater for high vapor content in the liquid for a hot spot length of 160 mm than it was for lengths of 500 and 945 mm. With a low content of steam in the fluid, the critical heat flux did not vary very much irrespective of tube length or mass velocity. (TTT)

30563 ECCENTRIC ROD BURNOUT AT 1000 lbf/in^2 WITH NET STEAM GENERATION. S. Levy, E. E. Polomik, C. L. Swan, and A. W. McKinney (General Electric Co., San Jose, Calif.). Intern. J. Heat and Mass Transfer, 5: 595-614(July 1962). (In English)

Burnout and pressure-drop tests were performed with an eccentric rod geometry to simulate possible maldistribution of flow in multirod fuel assemblies of boiling-water reactors. Data are presented for a uniformly heated rod, 0.540 in. in dia. and 8½ ft long, located within a circular pipe of 0.875 in ID. Test variables include one concentric and three displaced rod geometries, exit steam qualities from 9 to 66% by weight, flow rates from 0.25 to 1.34 × 10^6 lb/h ft^2, and system pressures of 1000 lbf/in^2. Test results are as follows: Burnout heat fluxes with net steam generation are the same for the concentric annulus of 0.1675 in. and the eccentric flow spacing of 0.096 and 0.061 in. Burnout values decrease by 15–36% when the minimum flow annulus is reduced from 0.1675 to 0.033 in. Single-phase pressure-drop tests exhibit a decrease in friction factor as the eccentricity increases. On the other hand, two-phase pressure losses remain relatively the same at various eccentricities. An analytical model is postulated to determine the degree of transverse mixing in an eccentric geometry. The model based upon subdividing the flow area into two parallel channels indicates that mixing extends well over half of the flow zone. (auth)

30564 A STATISTICAL ANALYSIS OF NUCLEATE-POOL-BOILING DATA. G. A. Hughmark (Ethyl Corp., Baton Rouge, La.). Intern. J. Heat and Mass Transfer, 5: 667-72(July 1962). (In English)

Nucleate pool boiling experimental data were analyzed with a statistical technique to obtain an eight variable equation for the heat flux. The dimensional derived equation considers only the thermodynamic properties of the liquid and vapor and neglects the effects of the surface condition, the geometry and orientation. The equation has no theoretical justification but it does indicate the best agreement with the experimental data that can be obtained when only the thermodynamic properties are considered as products of powers. An average absolute deviation of 40% was obtained between experimental and predicted heat flux for a range of materials from boiling hydrogen to boiling mercury. (auth)

30565 UNSTEADY-STATE HEAT AND MASS TRANSFER IN THE ROTATING-DISK–REVOLVING-FLUID SYSTEM. Donald R. Olander (Univ. of California, Berkeley). Intern. J. Heat and Mass Transfer, 5: 825-36(Sept. 1962). (In English)

The transient heat- and mass-transfer behavior of various rotating-disk-revolving-fluid combinations was investigated. The analysis assumes steady flow and instantaneous application of a temperature or composition change at the disk at zero time. The approach of the dimensionless heat- or mass-transfer parameters, the Sherwood or Nusselt numbers, to their steady-state values was investigated. The numerical computations for the pure rotating-disk case utilized both the true velocity profile and some limiting forms applicable to restricted regions of the Schmidt or Prandtl number and time. The results indicate that, for practical purposes, steady-state transfer is essentially instantaneously attained upon application of the new boundary condition. For Sc → ∞, the effect of interfacial velocity on the transient response is small. (auth)

30566 IMPROVEMENTS IN OR RELATING TO TUBULOUS HEAT EXCHANGERS. Norman George Worley (to Babcock and Wilcox Ltd.). British Patent 905,076. Sept. 5, 1962.

A tubulous heat exchanger is designed so that an increased number of tube limbs can be accommodated in a given space. The tube limbs are staggered and have return bends uniting consecutive tube limbs, and adjacent tube limbs of alternate tubes are spaced apart by distances less

than the tube limb external diameter. The cross section of the return bends is in the form of an ellipse with the minor axis smaller than the tube limb external diameter. (D.L.C.)

30567 IMPROVEMENTS IN OR RELATING TO ROTARY APPARATUS. Allan Barker and James Rostron Wright (to United Kingdom Atomic Energy Authority). British Patent 905,610. Sept. 12, 1962.

A centrifugal pump is designed for pumping corrosive liquids. The pump comprises a rotatable working member carried by a first shaft having two tubular parts connected at a transverse partition. The first shaft is internally supported by bearing on a pillar extending into that tubular part remote from the working member and is rotatable by a second shaft extending through the pillar and joined to the first shaft at the partition. (D.L.C.)

30568 IMPROVEMENTS IN OR RELATING TO ELECTROMAGNETIC LIQUID METAL PUMPING SYSTEMS. Leslie Reginald Blake (to United Kingdom Atomic Energy Authority). British Patent 905,940. Sept. 12, 1962.

An electromagnetic pump for liquid metals is designed which is of the type comprising primary and secondary ducts in an air gap in a magnetic circuit. When liquid metal is pumped through the primary duct, an emf is generated to provide an electromagnetic pumping action in the secondary duct. The ducts are longitudinally shaped to increase in width and decrease in thickness going away from the center of the magnetic circuit, in order to minimize efficiency losses due to by-pass current. (D.L.C.)

Instrumentation

Refer also to abstracts 30179, 30180, 30181, and 30186.

30569 (ANL-6579) SURFACE IONIZATION METHOD OF DETECTING HALOGEN-BEARING GASES. Harvey A. Schultz (Argonne National Lab., Ill.). July 1962. Contract W-31-109-Eng-38. 50p.

In an experimental investigation of positive ion production at heated surfaces, the primary objective was to develop a stable quantitative detector suitable for studies of movements of a gaseous tracer in the atmosphere or other large gaseous masses. Freon-12 (dichlorodifluoromethane) is well qualified as a tracer, since it is harmless to animals, plants, and equipment under ordinary conditions, is undetectable, except by special apparatus, and is not too expensive, considering that 0.1 ppm may be detected. Two phases of the work are discussed: the modification of a commercial detector to improve its reproducibility, and the investigation of the mechanism responsible for halogen sensitivity. A multiple-step process is involved. Steps studied included thermal decomposition of the Freon, release of alkali from a heated source and transfer through the carrier gas to a surface at high temperature, ionization, and ion collection by an electric field. Sensitivity may be lost by raising the halogen concentration enough to make ionization or ion collection the rate-controlling step, and this change is not immediately reversible. (auth)

30570 (BNL-4795) NEUTRON SPECTROSCOPY APPLIED TO THE BROOKHAVEN MEDICAL RESEARCH REACTOR. Charles G. Amato (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT(30-2)-Gen-16]. 13p.

A procedure is described for simple and reliable measurements of neutron spectra during steady state or pulsed reactor operation. The technique is based on the interaction of neutrons and nuclei having thresholds below which the reactions do not occur. The target material and neutron energy determine the reaction that is indicative of the neutron flux present above the threshold energy. If several threshold detectors are used, each with a different threshold energy, the total flux between the energies can be obtained. Measurements of neutron energy are made on thin foils with a neutron spectroscope. A list is included of materials that may be used as radioactivants and their properties. Activity is determined using a single channel analyzer. Half life is always determined. The entire procedure hinges upon determination of counter efficiency for each type of foil. Applications of the method by hospitals using neutron sources are discussed. (C.H.)

30571 (BNL-4950) AN EXACT ANALYTIC EXPRESSION FOR THE DIFFERENTIAL TIME DELAY SPECTRUM OF A SCINTILLATION COUNTER COINCIDENCE PAIR. John V. Kane (Brookhaven National Lab., Upton, N. Y.). Aug. 26, 1960. Contract AT-30-2-GEN-16. 4p.

An exact calculation based on the assumption that the time signal from a photomultiplier scintillator assembly occurs at the instant of the appearance of the nth photo electron is presented. It differs from previous calculations in that the statistical treatment does not employ the Poisson approximation. (auth)

30572 (DP-760) GAUGE FOR MEASURING BOW OF TUBES. Gretchen B. Alewine (Du Pone de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C. Aug. 1962. Contract AT(07-2)-1. 7p.

A mechanical gage was designed to measure the bow over any one-foot length of long cylindrical material. The gage was used successfully for measuring bow in components of tubular fuel elements at the Savannah River Laboratory. (auth)

30573 (GAMD-1961) A SMALL NEUTRON BEAM CHOPPER. W. L. Whittemore (General Atomic Div. General Dynamics Corp., San Diego Calif.). Jan. 18, 1961. Contract AT(04-3)-167. 7p.

A neutron chopper assembly is described which was used at a reactor in conjunction with a crystal monochromator to produce short bursts of monoenergetic neutrons for time-of-flight studies. Photographs and diagrams of the assembly are included. (J.R.D.)

30574 (HW-71142) NEUTRON FLUX MONITOR DETECTOR. R. L. Richardson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 22, 1961. Contract AT(45-1)-1350. 11p.

A mathematical analysis of the mechanisms in the detectors of neutron flux monitors is presented. The analysis is related to information given in Extended Lifetime Monitor Detector Problem, Nucleonic Instrumentation, HLO, D.E. Hegberg. (J.R.D.)

30575 (HW-SA-1917) ACHIEVEMENT FOR HANFORD. Maryann Long (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 19, 1960. Contract [AT(45-1)-1350]. 7p.

Design features of the Whole Body Counter are reviewed briefly. (C.H.)

30576 (HW-SA-1934) RADIATION MEASUREMENT BY MOTION PICTURES. D. C. Bowden and C. M. Thomas (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 23, 1960. Contract [AT(45-1)-1350]. 3p.

Motion picture analysis was expanded to accurately measure hand exposure for repetitive radiation operations. High exposure operations can be pinpointed in detail; generally the vast majority of the hand exposure occurs during a small portion of the total operation. This element can be

detected, further studied, and then minimized. One such application involving manufacturing a Pu component is described. (auth)

30577 (HW-SA-2032) SOME STUDIES OF FILM DOSIMETER VARIABLES. W. V. Baumgartner (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 1960. Contract AT(45-1)-1350. 28p.

Latent image fading was measured for duPont 552 film and Kodak Personnel Monitoring film, Type 2, for storage periods from one day to one year. Film developing techniques were analyzed and estimates of the variables were made. A statistical approach to determine the radiation detection limit and sensitivity for film is presented. (auth)

30578 (HW-SA-2145) A SIMPLIFIED FURNACE PROGRAMMER USING A TOTAL RADIATION PYROMETER. T. D. Chikalla (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [196?]. Contract [AT(45-1)-1350]. 6p.

A programming system is described which was designed for use in a series of sintering kinetic studies in which accurate and reproducible heating and cooling rates and soak times are required. The programming is accomplished by a set of integrated timers used in conjunction with a total radiation pyrometer. (J.R.D.)

30579 (HW-SA-2148) WIDE RANGE CURRENT DETECTOR. Wyndell C. Banister (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 17, 1961. Contract [AT(45-1)-1350]. 10p.

A wide range current detector was designed to produce an indicating signal if the current in a 120-volt a-c line should exceed 70 ma, but would not permit burnout of the detector if the current should approach 50 amp. Germanium diodes were used for the rectifying bridge. The size of the 5-ohm shunting resistor was calculated on the basis of current flow through the diodes and the 13-ohm coil impedance of the relay at pickup. Two high-current silicon rectifiers were placed in parallel across the 5-ohm resistor to shunt all high alternating currents. Tests indicated the device to be adequate for the specified current. (M.C.G.)

30580 (HW-SA-2178) EXPERIENCE WITH THE IONIZATION CHAMBER PULSE READER AT HANFORD. F. L. Rising (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 1961. Contract [AT(45-1)-1350]. 17p.

The various applications that were made of the ionization chamber pulse reader at Hanford are described. The types of measurements made, problems encountered, and the results obtained with various ionization chambers are discussed. Some typical applications are the measurement of natural background, air-borne tritium, hand dose, immersion dose in the Columbia River, and in vivo dose from internally deposited radionuclides with small chambers. (auth)

30581 (HW-SA-2624) SILICON SEMICONDUCTOR NEUTRON DOSIMETER. G. W. R. Endres, P. E. Bramson, and A. W. Medcalf (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 4, 1962. Contract [AT(45-1)-1350]. 17p.

Silicon diodes are being studied for use as fast neutron personnel dosimeters at Hanford. The dosimeters are made of 400 ohm-cm resistivity silicon cemented with silver paste between two small nickel contacts. The diodes are approximately 1/8 inch in diameter with several different base thicknesses. The change in the forward resistance due to fast neutron damage was studied as a function of the diode thickness. The 0.075-inch thick diodes showed greater damage per unit dose than 0.100, 0.065, 0.050, and 0.030-inch diodes. The forward resistance changes approximately lineally with fast neutron dose. Accumulated neutron dose up to 100 rads was studied. A fast neutron (average energy 2 Mev) dose detection limit of about 500 mrads was observed with 0.075-inch diodes. The diodes showed no detectable change in forward resistance with a dose to 500 r of radium-gamma radiation. The energy response of the diodes over the range of 0.200 to 17.0 Mev was measured for a given dose of monoenergetic neutrons. Some annealing of the neutron damage was evident in the first half-hour after irradiation, however, after the first hour the damage appears to be permanent for diodes maintained at room temperature. (auth)

30582 (IA-713) DESCRIPTION AND OPERATION OF A 4π BETA COUNTER. Progress Report. M. Pasternak and G. Ben-David (Israel. Atomic Energy Commission, Tel-Aviv). Apr. 1962. 17p.

The design and operation of 4π beta-counter, filled with P-10 gas (10% CH_4, 90% A) and using thin gold-coated collodion source mounts, is described. A plateau of 175 V was achieved. Conditions for obtaining the optimum plateau are discussed and the influence of negative ion formation due to oxygen and organic solvents is demonstrated. Absolute disintegration rates for Na^{24} and Au^{198} sources, measured by the counter, agree within 1 to 2% with those found by β-γ coincidence counting. (auth)

30583 (LA-2724) INDUCTION HEATER POWER CONTROLLER. Raymond A. Gore (Los Alamos Scientific Lab., N. Mex.). Mar. 1962. Contract W-7405-Eng-36. 65p.

The design of an automatic power controller for the output power of a 20 kw radiofrequency induction heater is presented. Controlling the output power of the heater results in constant power delivered to the load and, barring physical changes in the load, maintains the load at a constant temperature. The output power is proportional to the mean-square value of the radiofrequency current in the load coil. The load current is sensed by an inductively coupled pick-up loop. The mean-square value of the pick-up-loop voltage is measured and used as the feed-back signal in the closed loop controller. It is the characteristic of using the mean-square value of the voltage that allows this controller to maintain a nearly constant load temperature. (auth)

30584 (LA-2727) HIGH TEMPERATURE PRESSURE TRANSDUCER (Mk. I). L. H. Thacker (Los Alamos Scientific Lab., N. Mex.). June 1962. Contract W-7405-eng-36. 28p.

A rugged and reliable pressure transducer was developed for use in molten sodium systems at temperatures from 100 to 400°C. The device gave results accurate to approximately ±1% in bench calibration tests at temperatures up to 400°C, and performed satisfactorily in the molten sodium primary stream of a sodium-pumped molten plutonium-iron alloy loop. (auth)

30585 (LAMS-2734) PULSED RUBY LASER FOR PLASMA INTERFEROMETRY. D. E. Nagle, A. S. Rawcliffe, F. L. Ribe, and S. A. Schleusener (Los Alamos Scientific Lab., N. Mex.). July 30, 1962. Contract W-7405-Eng-36. 27p.

The construction and operation of a pulsed ruby laser are described. In this device the optical path of the photons between external mirrors is blocked by a biased Kerr cell as the ruby is optically pumped above threshold. A pulse to the Kerr cell then releases a single "giant" pulse of photons. A maximum power of 24 kW and a pulse dura-

tion of 0.1 μsec were obtained. It is intended to apply this light source to fast plasma interferometry for the determination of plasma cross-sectional shape and electron density with good time resolution. (auth)

30586 (NRL-5777) DOSIMETRY BY SOLID STATE DEVICES. F. H. Attix (Naval Research Lab., Washington, D. C.). June 15, 1962. 21p.

Any material which has a conveniently measurable parameter that varies as a function of the absorbed dose (or absorbed dose rate) deposited by ionizing radiation in the material can serve as the basis for a dosimetry system. A number of solid materials were investigated as dosimeters and found to be useful in various applications. The principal systems reported in the literature to date were based upon the following phenomena: the change in coloration (or optical density at a given visible or uv wavelength) produced in glass, plastics, or crystals by the action of the ionizing radiation; the uv photoluminescence of silver-activated phosphate glass after exposure to ionizing radiation; the degradation of the uv-excited luminescence of certain phosphors due to the action of ionizing radiation; the thermally excited luminescence of certain materials which are capable of storing energy from ionizing radiation in stable trapping centers; the luminescence produced by stimulation (after exposure to ionizing radiation) with light of longer wavelength than that omitted; the temporary change in electrical conductivity of a crystal or p-n junction while exposed to ionizing radiation; the open-circuit voltage or short-circuit current resulting from the photovoltaic effect in a p-n junction while exposed to ionizing radiation; and permanent changes in the conductivity of a material due to lattice dislocations brought about by high-energy radiation. Scintillators represent another very important form of solid state dose-rate measuring device, but these were omitted in this study because of extensive treatment elsewhere. A survey of much of the material published to date on solid state dosimetry is presented. A bibliography of 120 references is included. (auth)

30587 (NYO-9138) DEVELOPMENT OF A CATION EXCHANGE RESIN WITH SCINTILLATING PROPERTIES. Final Report. Alvin H. Heimbuch (Tracerlab. Div. of Lab. for Electronics, Inc., Richmond, Calif.). Apr. 1962. Contract AT(30-1)-2525. 63p.

A resin was synthesized which has the unique feature of possessing both ion exchange and scintillating properties. Cationic species of radioactive nuclides are readily adsorbed from aqueous solution in a manner similar to that of conventional ion exchange resins. Radioactive emanations from the captured nuclides result in the excitation of resin phosphors. The emitted light is of a wave length that effectively activates a photomultiplier tube of an S-11 or -13 response. Thus, radioactive isotopes can readily be counted by coupling the resin on which they are adsorbed to a photomultiplier tube and pulse counter. The resin was made by a suspension-type polymerization process as solid, spherical beads. The beads were made of polyvinyltoluene cross-linked with divinylbenzene and contained p-terphenyl and 1,4-bis-[2-(5-phenyloxazolyl)]-benzene (POPOP) dissolved in solid solution. Ionizing sulfonic groups ($-SO_3H$) were introduced on or near the surface of the beads by direct sulfonation of the aromatic nuclei. Exchange capacities in the range of 0.01 to 0.1 milliequivalents per gram of beads were obtained. Sr^{90}, Pu^{239}, and Po^{210} were counted with over-all efficiencies of 50, 30, and 40% respectively, using a multichannel pulse-height analyzer. A counting efficiency of 12% was obtained for Ni^{63} and 60% for Tl^{204} using a liquid scintillation counter. (auth)

30588 (RISÖ-36) AN AIR-BORNE SCINTILLOMETER. K. E. Neisig (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Apr. 1962. 19p.

A transistorized scintillometer designed for aerial radiometric surveys for measuring the total gamma background is described. A twin-lens 16-mm camera is used by double exposure to pick up all information of interest, such as flight-path, count-rate, and altitude. With fully loaded camera it should be possible to traverse an area corresponding to about a 200-km flight-line with a 60-mile flight-speed while giving 1 exposure per sec. (auth)

30589 (TID-16524) THE DIRECT MEASUREMENT OF LOCAL ABSORBED DOSE PRODUCED BY RADIATION BEAMS IN TISSUE MATERIALS. Annual Progress Report, July 1, 1961–June 30, 1962. John S. Laughlin (Sloan-Kettering Inst. for Cancer Research, New York). Aug. 1, 1962. Contract AT(30-1)-1451. 11p.

An all-carbon calorimeter, designed to measure directly the absorbed dose in tissue produced by 20 Mev and 10 Mev incident electrons, was calibrated and operated. A Fricke ferrous-sulfate system was irradiated in carbon in a geometry identical to that of the calorimeter and the "G" value of this system was determined for high energy electrons. (C.H.)

30590 (UCRL-5858) IMAGE CONVERTER TUBES—MANUFACTURER'S DATA. F. K. Inami (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 1960. Contract W-7405-eng-48. 11p.

A survey was made of the image converter tubes generally available in the U. S. and Europe. Ultraviolet and infrared types using photocathodes were included, but x-ray and solid-state types were omitted. The manufacturers are listed. Data presented include: photocathode, phosphor, resolution, magnification, distortion, and conversion gain. (M.C.G.)

30591 (UCRL-5962-T) THE USE OF TRANSISTORS IN HIGH SPEED TIME-TO-HEIGHT CONVERTERS. Richard P. Rufer (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 1960. Contract W-7405-eng-48. 22p.

A conventional time-to-height converter operates by charging a capacitor to a voltage proportional to a time interval. To convert short time periods, the circuitry is limited by the stray capacities. A system was designed in which the vernier chronotron principle is utilized to time scale the input time before time-to-height conversion. Accuracy is also improved over that attainable with conventional systems. The use of transistors is facilitated by the system design. (auth)

30592 (UCRL-5975) THE LRL CAPTURE-GAMMA COINCIDENCE SPECTROMETER. Joseph E. Schwaeger (California. Univ., Livermore. Lawrence Radiation Lab.). Apr. 22, 1960. Contract W-7405-eng-48. 33p.

A fast-slow coincidence scintillation spectrometer for gamma–gamma cascade measurements following thermal neutron absorption in nuclei is in operation at the Livermore 1-megawatt pool-type reactor. Design features of the spectrometer and experimental techniques in its use are discussed with particular emphasis on the application of the recently introduced sum-coincidence method for analysis of capture-gamma double cascades. A technique for the determination of added neutron binding energy is presented and various types of coincidence data from appropriate experiments are illustrated. (auth)

30593 (UCRL-6012-T) AVALANCHE TRANSISTOR SWITCHING. R. P. Rufer (California. Univ., Livermore.

Lawrence Radiation Lab.). May 6, 1960. Contract [W-7405-eng-48]. 11p. (LE-392-1)

The avalanche action of high-voltage silicon mesa transistors is discussed. Transistor characteristics, the mechanism of avalanche breakdown, control of avalanche breakdown, current avalanche, avalanche switching circuitry, and avalanche transistor evaluation of circuit design are described. (M.C.G.)

30594 (UCRL-6308) A HIGH VOLTAGE VIDEO AMPLIFIER. Donald R. Noel (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 1, 1961. Contract W-7405-eng-48. 3p.

A video amplifier having a ±30 v maximum output swing, a gain of 60 db, and a rise time of 14 nsec is described. The corresponding band width is 10 cps to 25 mc. (M.C.G.)

30595 (UCRL-6325) SOME EXPERIENCES WITH NOBLE-METAL METAL-SHEATHED THERMOCOUPLES. William E. Bostwick (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 6, 1961. Contract W-7405-eng-48. 25p.

Temperature measurements on a gas-cooled experimental nuclear reactor led to a study of materials and configurations of noble-metal, metal-sheathed thermocouples. The study is not complete, but some conclusions were reached. The $^1/_{16}$ in., 2-wire, platinum/90% platinum, 10% rhodium thermocouples, in commercial platinum sheaths with magnesia insulation, are shown to perform well to 2400°F. Data are presented to show that magnesia is usable as an insulator in $^1/_{16}$-in. sheathed thermocouples to 2900°F. A series of curves indicates that magnesia insulation depreciates very rapidly with increasing temperature. There is a tendency for the curves to coincide above about 2400°F. These curves also show that even if room temperature resistance is high, it does not follow that elevated temperature resistance will be high. A method of determining the uncertainty of measurement in a specific case is described; this uncertainty is about ±10°F. An outline showing future test plans is given. (auth)

30596 (UCRL-9200(Rev.)) A PRELIMINARY INVESTIGATION OF THE SYSTEM TIME SPREAD FOR SOME TYPES OF MULTIPLIER PHOTOTUBES. Yahia El Hakim (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 1960. Contract W-7405-eng-48. 22p.

A preliminary investigation of four types of multiplier phototubes under conditions simulating their use in scintillation and Cherenkov nuclear detectors is described. The investigation involves time-spread and rise-time measurements at different reference points on the output pulses, as well as observations of some special characteristics of these tubes. (auth)

30597 (UCRL-9231) AUTOMATIC SCANNING AND MEASURING OF BUBBLE CHAMBER PHOTOGRAPHS. Antonio Grasselli (California. Univ., Berkeley. Lawrence Radiation Lab.). June 1, 1960. Contract W-7405-eng-48. 60p.

The development of high-energy charged particle accelerators, such as the Bevatron, and of improved nuclear-event detection devices, such as the Berkeley 72-in. H_2 bubble chamber, has greatly increased the need for high-speed data reduction of nuclear events. Full exploitation of the potential of the 72-in. bubble chamber demands a very high-speed analysis system. An approach to such a system is described. (auth)

30598 (UCRL-9298) USE OF PYROELECTRIC DEVICES FOR MEASURING SMALL TEMPERATURE CHANGES. Sidney B. Lang (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). July 1960. Contract W-7405-eng-48. 17p.

A technique for measuring extremely small temperature changes by means of a pyroelectric device is described. The sensing element is a short, thin rod of polarized barium titanate ceramic with electrodes on the ends. The electric charges produced by changes in temperature are measured by a vibrating-reed electrometer. The device is sensitive to temperature changes as small as 2×10^{-4}°C, and modifications can be made to achieve much greater sensitivity. The device is free of ordinary thermometric errors. A number of calorimetric and noncalorimetric applications for the device are suggested. (auth)

30599 (UCRL-9513) ENERGY RESPONSE AND PHYSICAL PROPERTIES OF NTA PERSONNEL NEUTRON DOSIMETER NUCLEAR TRACK FILM. Richard L. Lehman (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 13, 1961. Contract W-7405-eng-48. 41p.

A study was made of the chemical and physical properties of the Eastman Type A (NTA) film packet. It correlates with these properties the response of this packet to neutrons of various energies. In this correlation the concept of the track unit is introduced as a basic unit for reporting film-packet response. (auth)

30600 (UCRL-9529) ELECTRICAL LIMITATIONS TO ENERGY RESOLUTION IN SEMICONDUCTOR PARTICLE DETECTORS. William L. Hansen and Frederick S. Goulding (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 5, 1961. Contract W-7405-eng-48. 18p.

Based on the assumption that the noise contribution of a semiconductor detector is due solely to the bulk properties of the semiconductor, equations are presented which indicate the theoretical limits of noise in detector-amplifier combinations. The equations show that an optimum amplifier time constant and detector bias voltage exist for which condition the minimum noise is independent of the semiconductor resistivity. The optimum performance of a detector-amplifier system is shown to depend only upon detector area, input capacity (less detector capacity), semiconductor minority carrier lifetime, and the transconductance of the amplifier input tube. A new detector structure including a guard-ring electrode as an integral part of the detector structure is described which largely eliminates noise due to surface leakage. Experimental results for detector leakage and energy resolution are presented which agree well with theory. The theoretical limit of noise, expressed as full width at half maximum, is in the range of 7 to 10 kev for 1-cm^2 p-type silicon detectors at 25°C. (auth)

30601 (UCRL-9624) FAST PULSE-AMPLITUDE DISCRIMINATORS. Dick A. Mack (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 30, 1961. Contract W-7405-eng-48. 24p.

A review of the state-of-the-art concerning these descriminators is presented. It is noted that such devices are useful in nuclear counting to separate signals of greater amplitude from a background of unwanted noise signals or those of lesser amplitude. Information is included on basic circuits and practical circuits which illustrate the present development. (J.R.D.)

30602 (UNC-5028) DEVELOPMENT OF A CONTINUOUS METER FOR OXYGEN IN SODIUM. Quarterly Progress Report, March 1, 1962–May 31, 1962. H. Steinmetz (United Nuclear Corp. Development Div., White Plains, N. Y.). July 15, 1962. Contract AT(30-1)-2877. 17p.

Previous experiments showed that it is possible to monitor the concentration of sodium oxide dissolved in liquid Na

by an electrochemical method. The electrochemical cell consists of a metal-metal oxide electrode, a calcia-stabilized zirconia electrolyte, and an electrode of Na containing the dissolved sodium oxide whose concentration the cell determines. In current experiments an electrochemical cell was operated satisfactorily for 1100 hours at 500 to 600°F. The electrochemical cell was found to give a good response to changes in O_2 concentration at temperatures of 550°F and 650°F. The response was poor at 750°F, while at 900°F there was little or no response. Preliminary measurements yield values for the temperature coefficient of this cell in the range of −0.41 to −0.62 mv/°F. (auth)

30603 (AEC-tr-5368) LIQUID SCINTILLATOR DETECTORS FOR RECORDING NEUTRONS. I. Vizi, G. P. Zhukov, G. I. Zabiyakin, E. N. Karzhavina, L. B. Pikel'ner, A. B. Popov, E. I. Sharapov, and Yu. S. Yazvitskii. Translated from p.27-36 of "Proceedings of the Conference on Nuclear Electronics, held in Belgrade, May 15-20, 1961. Vol. I" (a publication of the International Atomic Energy Agency, Vienna, 1962). (STI/PUB/42(Vol. I(p.27-36)). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 20709.

30604 EXAMINATION OF A COUNTER WITH 2π GEOMETRY IN A WIDE BETA-ENERGY RANGE. E. Danóczy and L. Tari (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). Atompraxis, 8: 285-8(Aug. 1962). (In German)

Characteristic data for a windowless G-M counter with a new measuring-gas mixture are described. In measurements of C^{14} the influence of increasing activities on effectiveness, as well as the effect of the input sensitivity of scalers on the characteristics obtained, were tested. Results were compared with those of measurements carried out with β rays in the energy range from 0.15 to 1.7 Mev. Scattering effects of the newly constructed G-M counter were also studied. (auth)

30605 THE INFLUENCE OF LACKING SATURATION CONDITIONS ON THE MEASUREMENT OF HOMOGENEOUSLY DISTRIBUTED ACTIVITIES. R. Plesch (Siemens and Halske AG, Karlsruhe, Ger.). Atompraxis, 8: 297-303 (Aug. 1962). (In German)

In continuation of an earlier study, the theoretical treatment of measurement sensitivity for homogenecusly distributed activities in water and air is extended to the field of lacking saturation conditions. Formulas are derived for measurement under saturation conditions as a special case. The auxiliary functions necessary for the use of these formulas are presented in diagrams, and their practical application is explained with the aid of examples. (auth)

30606 MEASUREMENT OF SLIGHT GAMMA ACTIVITIES WITH A WELL-TYPE SCINTILLATION COUNTER AND SINGLE-CHANNEL DISCRIMINATOR. H. Dreiheller (Frieseke and Hoepfner GmbH, Erlangen, Bruck, Ger.). Atompraxis, 8: 303-6(Aug. 1962). (In German)

A discussion is presented on the points of view determining the choice of instruments, operating conditions, and optimum adjustment of the equipment, and practical directions are given for carrying out the measurements. Under these conditions, a sufficient time constancy for the yield can easily be obtained. As an example, a list is given of the yield values and background obtained in the measurement of I^{131} and Ca^{137}. The instruments for other measurements with single-channel discriminators can be adjusted according to the same principle. (auth)

30607 DOSE SENSITIVITY OF GEIGER MÜLLER COUNTERS FOR X-RAYS AND GAMMA RAYS PART II. K.-H. Weber (VEB Vakutronik, Dresden). Atompraxis, 8: 307-10(Aug. 8, 1962). (In German)

The dose sensitivity of Geiger-Müller counters for quantum radiation in relation to quantum energy in the range from 10 kev to 3 Mev was calculated for various wall materials, wall thicknesses, filling gases, and filling pressures. For counters with excess air-equivalent gas fillings and sufficiently high filling pressures, the dose sensitivity, as a function of quantum energy, has a maximum at lower energy levels and a minimum at higher energy levels. Practical measures are given for reducing the energy dependence of dose sensitivity. (auth)

30608 NUCLEAR AUTOMATION AND INSTRUMENTATION—THE MULTIDIMENSIONAL SELECTORS. R. Wahl. Automazione e Strumentazione, 9: 423-31(Sept. 1961).

An attempt was made, using multichannel analyzers and velocity selectors, to arrive at a generalization of multidimensional separators. Discussion is given on 100- to 400-channel amplitude selectors, magnetic memory selectors, 1000-channel flight time selectors for neutrons of different velocity, time-amplitude converters, torus memory storage for up to 10^6 pulses, and magnetic drum and magnetic band storage. The application of a combination of the electronic devices is illustrated by determining the γ-γ-coincidences of the 2 γ rays emitted by Co^{60}, the pairing effect of Na^{24}, and the activation analysis of one radioisotope in a small quantity in the presence of other radioisotopes. Thus the amplitude selectors for flight time lose their individuality by being integrated into computers. Simple ferrit calculators are used for information storage. Complex data are collected by perforated bands and conveyed to digital computers for resolution. (OID)

30609 ACCURATE MEASUREMENTS OF RADIOACTIVITIES BY THE 4 PI BETA-GAMMA COINCIDENCE METHOD. Yasushi Kawada, Osamu Yura, Toshiyuki Hiramoto, and Tsutomu Noguchi. Bull. Electrochem. Lab. (Tokyo), 26: 389-96(May 1962). (In Japanese)

A detailed discussion is given on accurate measurements of radioactivities by the 4 pi beta-gamma coincidence method, together with explanations on the construction and the performance of the measuring device used at the Electrotechnical Laboratory. It is noted that a comparatively intense radioactivity should be used for a sample to reduce the measuring error based on the fluctuation of background counts. The values of various correction factors necessary in the case of high counting rate are accurately calculated by the consideration and the experiments described. The statistical error is also discussed from the standpoint of sampling theory, and is obtained as

$$\sigma = \sqrt{\frac{1}{N_0 T} + \frac{(1-\epsilon_\beta)(1-\epsilon_\gamma)}{N_0 T \epsilon_\beta \epsilon_\gamma}}.$$

A series of these techniques may assure high accuracy in the determination of disintegration rate. For example, the maximum error is estimated at +0.35% and −0.25% in the case of Co^{60}. (auth)

30610 TWO-BARRIER DETECTOR. Z. Trousil (Inst. of Solid State Physics, Czechoslovak Academy of Sciences, Prague) and M. Skřivánková. Czechoslov. J. Phys., 12: 534-7(1962). (In English)

The principle of a detector with two opposite surface barriers, and the experimental verification of its functioning are described. The detector permits a large effective depth to be attained on the material with a given bias voltage. The principle of opposite barriers also permits a

reduction of the system of dE/dx and E detectors to one detector. (auth)

30611 DETERMINING THE SENSITIVITY OF A QUANTOMETER FOR MEASURING GAMMA RAY ENERGIES IN THE RANGE OF 15 TO 300 Mev. A. P. Komar, S. P. Kruglov, and I. V. Lopatin (A. F. Ioffe Inst. of Technical Physics, USSR). Doklady Akad. Nauk, S.S.S.R., 145: 309-11(July 11, 1962). (In Russian)

A beam of γ rays was directed to a block of material, and the ionization current i(t) in a thin gas-filled slit was measured as a function of the block depth. A plot was made of ionization versus depth, and the area under the curve $S_{exact} = \int^{\infty} i(t)\,dt$ is proportional to the incident current of energy U, that is, $U = (\omega\bar{\rho}/e)(\delta_s/\delta^0_{gas})\,S_{ex}$, where ω is the energy consumed in the formation of ion pairs in the gas, e is the charge of the electron, $\bar{\rho}$ is the ratio of ionization losses (in g/cm^2) in the solid and in the gas, averaged over the secondary electron spectrum, and δ_s and δ_{gas} are the density of the solid and gas respectively. A quantometer, a multi-plate ionization chamber, was constructed to determine the approximate area $S_{approx.}$ under the ionization curve by Simpson's rule. Then, the area $S_{approx.}$ was related to the ionization current I by the ratio $(\bar{a}/X_0)\,S_{approx.}$, where X_0 is the plate thickness (about 1 cm for copper), and $\bar{a}$ is the average gap width between the plates (about 0.15 cm for 12 plates). At a gamma energy $E_\gamma > 100$ Mev, $S_{approx.} = S_{ex}$ within 1%. The sensitivity C of the device, which is equal to I/U, is then: $C = I/U = (e/\omega\bar{\rho})(\delta_{gas}/\delta_s)(\bar{a}/X_0)$. This sensitivity must be corrected by a factor F for various values of E_γ. It was found that F is equal to 0.998 at $E_\gamma = 330$ Mev, 0.985 at $E_\gamma = 85$ Mev, 0.970 at $E_\gamma = 46$ Mev, and 0.93 at $E_\gamma = 15$ Mev. The readings of the quantometer were compared with the experimental results obtained by calorimetric measurements. The total change in sensitivity over the range of energies from 15 to 300 Mev does not exceed 10%. Hence, a quantometer of this type can be used to make absolute measurements of high-energy γ rays above 15 Mev. (TTT)

30612 THE STRUCTURE AND DIMENSIONS OF THE SENSITIZATION CENTERS AND OF THE IMAGE-DEVELOPMENT CENTERS IN A HIGHLY-SENSITIVE, TYPE P, NUCLEAR EMULSION. D. M. Samoilovich, V. I. Kalashnikova, and E. S. Barinova. Doklady Akad. Nauk S.S.S.R., 145: 778-81(Aug. 1, 1962). (In Russian)

It was shown previously that atomic silver, which is responsible for the image-development centers in a nuclear emulsion, is dissolved out of the emulsion by dilute acids. The density of ionization along the track of a fast, charged particle in the emulsion was taken as a parameter to determine the effect of the acid treatment on the sensitization image and on the latent image. Acid-treated samples of emulsion and control samples of emulsion, which had no backing and were 400 μ thick were irradiated with γ quanta which form fast electrons in the emulsion. The ionization density was found to be 25 spots per 100 μ in the control samples, and in the samples treated with a solution of pH 3 to 7. The density falls to 18 spots per 100 μ for an acid-treating solution with a pH of 1. In sensitizing the emulsion with gold, about 70% of the centers become resistant to the effect of acid. The atomic silver centers are thought to be the cause for the occurrence of photographic fog. Samples of emulsions were also irradiated with electrons, 8.6 Bev protons, and μ mesons from cosmic radiation. The ionization density fell from 25 spots per 100 μ for the control emulsion to 10 spots per 100 μ for the emulsion treated with an acid solution at a pH of 1. The results show that the image-development centers are associated with atomic silver which can be completely dissolved by acid. Most of the sensitization centers are protected by the previous chemical treatment, and are not dissolved by acid. (TTT)

30613 CERTAIN OPERATIONAL CHARACTERISTICS FOR C.E.C. 21-103C MASS SPECTROMETER USING BORON TRIFLUORIDE. K. N. Bhide and S. C. Saxena (Atomic Energy Establishment, Trombay, India). Indian J. Phys., 36: 224-36(May 1962).

Several very useful characteristics, essential for an adequate performance of the C.E.C. 21-103C type mass spectrometer, were recorded by using boron trifluoride gas samples. Dependences of ion current on the energy of the ionizing electrons, ionizing current, sample pressure, repeller settings and magnet current were discussed. Consideration was given to the cracking pattern of boron trifluoride gas, memory effects, and the percentage efficiency of the filament. (auth)

30614 STUDY ON THE PREPARATION OF THE NEW NUCLEAR EMULSIONS BY USE OF POLYVINYL ALCOHOL AND THEIR PHOTOGRAPHIC PROPERTIES ON RADIATION RAYS. Etsuo Fujii (Government Chemical Industrial Research Inst., Tokyo). J. Sci. Hiroshima Univ. Ser. A-II, 25: 185-205(July 1961). (In English)

Very fine grains of silver bromide could be dispersed into polyvinyl alcohol (PVA) solution without producing their coarse grains by use of the simultaneous mixing method, and the thermoreversible gel of PVA solution could be formed by use of the freezing method. These methods were applied to produce the new nuclear emulsions which contained 70% of AgBr by weight by using PVA as the protective colloid, and these were successful. The new PVA nuclear plate was able to record the clear delineation of track of α particles in its emulsion layer, and as to the photographic dosimetry of γ rays the plate showed sufficient blackening on γ ray radiation in the range of 10^2 to 6×10^3 roentgens. The hypersensitization of the emulsion by triethanolamine on radiation rays and the fading effect of the latent image of radiation rays were discussed. (auth)

30615 A MODIFIED TIME-OF-FLIGHT MASS SPECTROMETER FOR STUDYING ION-MOLECULE OR NEUTRAL PARTICLE-MOLECULE INTERACTIONS. R. S. Lehrle, J. C. Robb, and D. W. Thomas (Univ. of Birmingham, Eng.). J. Sci. Instr., 39: 458-63(Sept. 1962).

An account is given of the construction, operation, and applications of an ion source and its auxiliary equipment, which can provide ion beams up to 5 μa. The apparatus can supply continuous or pulsed beams of ions or energetic neutral atoms, radicals, or molecules, with chosen translational energy from 0 to 2000 ev. It is used in conjunction with a time-of-flight mass spectrometer to study ion–molecule interactions or neutral particle–molecule interactions of two types, viz. gas-phase collisions and the sputtering of surfaces. (auth)

30616 GEIGER COUNTER DEAD-TIME REDUCTION. J. H. L. Smuts (Univ. of Cape Town, Rondebosch, South Africa). J. Sci. Instr., 39: 475-7(Sept. 1962).

A simple, fast quenching circuit for Geiger counters is described. Dead-times in the vicinity of 10 μsec are realized for both halogen- and organic-quenched counters. (auth)

30617 GLOWING PROBE FOR SPACE POTENTIAL MEASUREMENT IN GAS DISCHARGES. M. Sato and Y. Hatta (Tohoku Univ., Sendai). J. Sci. Instr., 39: 481-2 (Sept. 1962).

Measurement of space potential in gas discharges by

means of a Langmuir probe is rather difficult. The glowing probe is introduced to solve this difficulty. It has a mechanism for producing an auxiliary glow discharge and emits electrons from the probe surface into the plasma to be measured. The space potential is given as the separating point of the two probe curves measured with and without the auxiliary glowing current. (auth)

30618 ELECTRON GUNS FOR CROSSED FIELD DEVICES. A. G. Stainsby (General Electric Co. Ltd., Wembley, Eng.). Nachrtech. Fachber., 22: 5p. (1961).

A model for the characteristics of electron guns is presented, taking into account space-charge effects and assuming laminar flow in the electron stream. Further, it is assumed that at the exit from the gun region, a limiting perveance is reached corresponding to the condition that the space charge fills the region from the outer edge of the beam to the cathode. The effects of variations of the cathode geometry on the characteristics are studied. To first order, the effects of cathode length are found to be negligible. Comparison of the model with experimental data indicates that the actual flow in the electron stream is, if not laminar, at least energetically similar to laminar flow. (T.F.H.)

30619 FAST WAVE INTERACTIONS USING CYCLOTRON RESONANCE. A. Reddish (General Electric Co. Ltd., Wembley, Eng.). Nachrtech Fachber., 22: 6p. (1961).

The interaction of an electron beam with crossed (steady) magnetic and (microwave-frequency-oscillating) electric fields are studied, for electric-field frequencies near the electron cyclotron resonance frequency. The efficiencies of such crossed-field devices for traveling-wave applications are investigated, for both forward- and backward-wave operation. Experimental results obtained using a particular electrode configuration are shown. (T.F.H.)

30620 AMPLIFICATION OF NEUTRON DETECTOR PULSES USING DIFFERENTIATION AND INTEGRATION CIRCUITS. A. R. Freeman and J. D. Sewill (Southampton Univ., Eng.). Nuclear Energy, 279-83(July 1962).

The selection of optimum values for time constants by using appropriate graphs is discussed. The action of the differentiating and integrating time constants is to reduce the frequency response of the amplifier at the low- and high-frequency ends, respectively. Because of the nature of the pulse fed to the amplifier, its duration may be shortened by reducing the differentiating time constant, thereby increasing the resolving power. In addition, the signal-to-noise ratio, and also the resolving power, may be maximized by having the two time constants equal. Points to be considered when choosing the time constants are summarized. An example of the method employed in choosing the most suitable value of T_1 and T_2 in a specific case is given. (P.C.H.)

30621 TINY GAMMA DETECTOR FOR HIGH-INTENSITY RADIATION. Richard G. Saelens (U. S. Army Signal Research and Development Lab., Fort Monmouth, N. J.). Nucleonics, 20: 60-4(Sept. 1962).

A miniature gamma dose-rate detector was developed which has microsecond resolution and can be used to measure dose rates of gamma pulses up to the Mrad/sec range. The detector, called the Magnesium-Oxide Radiation Detector, is based on electron multiplication by a magnesium oxide–magnesium oxalate layer on a titanium envelope after the envelope is bombarded by gamma rays. Results of detector tests are described. The response was found to be linear to the radiation rate and independent of the radiation energy. (D.L.C.)

30622 DESIGN AND PERFORMANCE OF NUCLEAR MAGNETIC-RESONANCE SPECTROMETER. A. N. Lyubinov, A. F. Varenik, and I. Ya. Slonim (Scientific Research Inst. of Plastics, USSR). Zavodskaya Lab., 28: 991-5(1962). (In Russian)

A design is given of a high-frequency nuclear magnetic resonance spectrometer facility consisting of a magnetic system, temperature regulating system, and control room with receiving and recording equipment. (R.V.J.)

30623 ELECTROSTATICAL ANALYSER WITH THE LINEAR POTENTIAL ON ELECTRODES. V. V. Sashkvara and M. I. Korsunskii (Khar'kov Polytechnic Inst.). Zhur. Tekh. Fiz., 32: 840-7(July 1962). (In Russian)

Linear distribution potential on limited-height coaxial cylinder sides are used for producing multi-sector charged particle analyzers. The linear distribution potential is capable of accurate control of analyzer ion-optic properties. (R.V.J.)

30624 ON THE CALCULATION OF MAGNETIC SPECTROMETERS. Kh. Keck. Zhur. Tekh. Fiz., 32: 859-66 (July 1962). (In Russian)

A three-column matrix method was developed for calculating the influence of small dispersion pulses in charged-particle spectrometers. The method permits calculations of image distances, enlargements, and dispersion, and resolution without considering each optical element separately. Derived equations are reduced to the universal relations for intermediate images and other magnet properties. The method can be utilized for calculating properties of electric field spectrometers. (tr-auth)

30625 ECONOMIC ASPECTS OF BUILDING AND OPERATING A WHOLE BODY COUNTER. Stelios Regas (Metrix, Inc., Deerfield, Ill.). Prepublication Copy. 14p.

The uses of the counter will dictate its size and form and by careful selection of components one can optimize the results. Although 150 to 250 thousand dollars will be required for a sophisticated unit capable of obtaining maximum sensitivity, a working system can be acquired for a tenth of this price. Such a whole body counter can be purchased, including a good steel shield ($14,000), a sodium iodide 4" × 4" crystal ($2,000), a single channel pulse height analyzer with all the other electronics ($3,000), and accessories including suspension, chair, ventilation, etc. ($1,000), for a total of $20,000. (auth)

30626 PHOTOMULTIPLIER SINGLE-ELECTRON STATISTICS AND THE SHAPE OF THE IDEAL SCINTILLATION LINE. J. R. Prescott (Univ. of Alberta, Calgary, Can.). Prepublication Paper. 37p.

The part played by photomultiplier single-electron statistics in determining resolution of scintillation counters is theoretically discussed and a statistical model is proposed that leads to an expression for the shape of the ideal scintillation line which is compared with experimental line shapes. (auth)

30627 A TRANSISTORIZED SURFACE CONTAMINATION MONITOR WITH QUASI-LOGARHYTHMIC SCALE. T. Niewiadomski. 7p. of "Pierwsze Krajowe Sympozjum Zastosowali Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

A portable device for large area contamination monitoring in radiochemical laboratories is described. The device consists of a mobile box (230 × 75 × 70 mm in size) which has flexible joints of aluminum piping. A handle and the scale of the instrument are attached to the other end of the piping. With this device, it is possible to detect 10 μC of Sr^{90}. (OID)

30628 ISOTOPIC SPEED GAGES FOR MEASURING THE WATER CIRCULATION IN STEAM GENERATORS 130 T/H 40 ATM. W. Wiśniewski. 11p. of "Pierwsze Krajowe Sympozjum Zastosowań Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

The isotopic method was applied to the measurement of water flow velocity in studies on the dynamic properties of steam generators. The critical state of water flow circulation was determined by using isotopic speedmeters containing a Co^{60} source. (OID)

30629 A POCKET "WHISTLING" RADIATION MONITOR. T. Niewiadomski. 7p. of "Pierwsze Krajowe Sympozjum Zastosowań Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

A transistorized monitor (122 × 68 × 26 mm in size and weighing 300 g) was developed for warning personnel by means of a loud whistle when the dosage rate increased over a set threshold. In case of a further increase in the dosage rate, the tone frequency of the whistle becomes louder. (OID)

30630 REDUCING NUCLEAR POWER COSTS WITH IMPROVED INSTRUMENTS. John N. Wilson (E. I. du Pont de Nemours & Co., Aiken, S. C.). Preprint Paper No. 28. New York, Engineers Joint Council, 1962. 29p.

Special instruments needed to reduce nuclear power costs and the work being done toward their development are discussed. These instruments will be used to test nondestructively the fuel elements to assure their quality, to monitor reactor cores to assure flux flattening and the early detection of fuel failures, and to permit continuous chemical separation by providing in-line analysis without delay. (49 references) (A.G.W.)

30631 IMPROVEMENTS IN APPARATUS FOR THE DETECTION OF RADIOACTIVE NUCLEAR FISSION PRODUCTS. Frank Harlen and David Gurney Arnold Thomas (to Dowty Electric Ltd.). British Patent 904,267. Aug. 29, 1962.

An apparatus is designed to detect fission products in the coolant gas of gas-cooled reactors. The apparatus comprises a pressure vessel, a precipitation chamber, a radiation detector, and pulley means for guiding a wire conductor through the precipitation chamber and detector. The pulley means is driven by a gas pressure motor powered by pressure differentials in the coolant circuit. The apparatus is compact in form and efficient in operation over a long period without servicing. (D.L.C.)

30632 IMPROVEMENTS IN OR RELATING TO EXTENSOMETERS. William Henry Irvine (to United Kingdom Atomic Energy Authority). British Patent 904,342. Aug. 29, 1962.

An extensometer of the capacitance type is designed which uses an electromagnetic resonance to determine the surface strain of a test body. The extensometer comprises two brackets mounted on the test body, two capacitor plates carried by the brackets and forming an electromagnetic resonator with the brackets, and an electromagnetic exciter coupled inductively with the brackets. (D.L.C.)

30633 DETECTOR FOR DETECTING CHARGED PARTICLES. (to Hughes Aircraft Co.). British Patent 904,507. Aug. 29, 1962.

A Si semiconductor detector with a p-n junction is designed which discriminates between individual incident particle events and gives an output proportional to the incident particle energies. The crystal has a ratio of resistivity on one side of the junction to that on the other side of at least 10^6 to 1, and it is reverse-biased to create a depletion region within one micron of the incident particle surface. The performance of the detector with alpha particles and the spontaneous fission spectrum of Cf^{252} is discussed. (D.L.C.)

30634 IMPROVEMENTS IN HALL EFFECT MAGNETOMETERS. Lydie Koch and Gerard Lambert (to Commissariat á l'Énergie Atomique). British Patent 904,521. Aug. 29, 1962.

A Hall effect magnetometer is designed whose accuracy is independent of small current variations. The magnetometer has a resistor arrangement for comparing the Hall voltage with the voltage collected from the potentiometer. (D.L.C.)

30635 SCINTILLATORS. David Gudy Anderson, Joseph Dracass, and Terence Patrick Flanagan (to United Kingdom Atomic Energy Authority). British Patent 905,391. Sept. 5, 1962.

A scintillator for detecting radiations is described which comprises a layer of luminescent glass fused to a non-luminescent glass base. The base may be the outer face of a photomultiplier tube, and the luminescent layer may be laminated in form, with each layer being responsive to different radiations. The fabrication of such a scintillator is described. (D.L.C.)

30636 APPARATUS FOR DETECTING THE PRESENCE AT A PARTICULAR LOCATION OF A SUBSTANCE OF RELATIVELY LOW ATOMIC NUMBER. Peter Kenneth Tomkins (to Burndept Ltd.). British Patent 905,401. Sept. 5, 1962.

An apparatus using gamma radiation emitted from materials bombarded with beta particles is designed for locating the level of liquid in a closed tank. The apparatus comprises a beta source within the tank at a short distance from its wall and a gamma detector outside the tank near the source. The liquid should be of smaller atomic number than the tank. (D.L.C.)

30637 IMPROVEMENTS IN OR RELATING TO METHODS OF DETECTING NEUTRON FLUX AND NEUTRON FLUX DETECTION DEVICES. Alan Lyle Gray (to Plessey Co. Ltd.). British Patent 905,464. Sept. 12, 1962.

A neutron flux detection device of the ionization chamber type is designed for determining the flux distribution in a reactor. The chamber comprises a hollow anode supported within a hollow cathode, and a cable is provided for supporting the device in a reactor and for electrical connections. The facing surfaces of the electrodes are coated with a material having a high cross section for neutron-induced reactions, e.g., B^{10} or U^{235}, and the interior of the chamber is filled with an ionizing gas. (D.L.C.)

30638 IMPROVEMENTS IN OR RELATING TO VIRTUAL-EARTH AMPLIFIERS. Donald Harrison (to United Kingdom Atomic Energy Authority). British Patent 906,068. Sept. 19, 1962.

A d-c amplifier is designed for use as a differentiating amplifier in reactor period meters. The amplifier includes a feedback resistor connected between input and output for virtual-earth input conditions and is provided with a smoothing circuit comprising a first capacitor connected in series with a second resistor across the feedback resistor. A pair of oppositely poled diodes is connected in parallel between the first capacitor-second resistor junction and the virtual-earth potential, so that the first capacitor acts in parallel with the feedback resistor to give a long time constant for smoothing input noise and is connected to the virtual-earth point during input changes to reduce the time constant. Thus, the overshoot of the reactor period indication is reduced. (D.L.C.)

30639 RADIATION DETECTION AND WARNING LABEL. Heinz F. Nitka (to General Aniline and Film Corp.). U. S. Patent 3,051,837. Aug. 28, 1962.

A colorimetric radiation dosimeter is described which is in the form of a label for application to a substance being irradiated. The dosimeter comprises an adhesive backing, a photographic high-speed print-out paper which changes color with radiation dose, a step wedge with perforations for comparing the print-out paper with the wedges, and a filter material to protect the paper from printing out due to light exposure. (D.L.C.)

30640 NEUTRON PYROMETER. Archie W. Culp, Jr. (to Astra, Inc.). U. S. Patent 3,051,838. Aug. 28, 1962.

A neutron radiation pyrometer is designed for measuring extremely high temperatures. The pyrometer comprises a neutron source for bombarding a material, two neutron sensors of different neutron energy response for detecting the reflected neutrons, and means for deriving a relative response from the sensors as an indication of the temperature of the material. (D.L.C.)

30641 SPECTROSCOPE. Hans Martin Bolz (to Bodenseewerk Perkin-Elmer and Co., GmbH). U. S. Patent 3,052,154. Sept. 4, 1962.

A spectroscope is designed which may be used to utilize simultaneously several wavelengths for comparing absorption bands. In the spectroscope, a spectrally fan-shaped real image of the entrance slit is formed in cyclic succession on a plurality of masks, causing different ranges of the spectrum to impinge successively in exactly the same manner on a radiation detector. The spectroscope is especially suitable for use with infrared radiation. (D.L.C.)

30642 HIGH INTENSITY DOSIMETER. Stanley Kronenberg (to U. S. Army). U. S. Patent 3,052,797. Sept. 4, 1962.

A dosimeter of the secondary electron type is designed for measuring high-intensity nuclear radiations and very fast changes in dose rates with a linear response, and its sensitivity may be varied in a simple manner through a wide range. The dosimeter comprises an evacuated chamber, an emitter in the chamber and made of organic hydrogenous material, a collector electrode at positive potential in the chamber, and means for measuring the current produced by the secondary electrons. (D.L.C.)

30643 POWER SUPPLY FOR IONIZATION DEVICES IN WELL BORES. Ralph H. Firminhac (to Halliburton Company). U. S. Patent 3,052,798. Sept. 4, 1962.

A rectifier power supply arrangement is designed for use with a Geiger counter well logging system. In this system, the counter and rectifier supply source in a well bore are connected through a cable to a low-voltage a-c power supply and to indicating means on the surface. A transformer serves as a step-up transformer between the power supply and the supply source and as a step-down transformer for matching the impedance of the counter to the cable and indicating means. (D.L.C.)

30644 ELECTRICAL PULSE COUNTER APPARATUS. W. M. Kaufman and T. A. Jeeves (to U. S. Atomic Energy Commission). U. S. Patent 3,052,801. Sept. 4, 1962.

A progressive electrical pulse counter circuit is designed for the counting of a chain of input pulses. The circuit employs a series of direct connected bistable counting stages simultaneously pulsed by each input pulse and a delay means connected between each of the stages. Each bistable stage has two d-c operative states, which stage, when in its initial state, prevents the next succeeding stage from changing its condition when the latter stage is pulsed. Since the delay circuits between the stages prevents the immediate decay of the d-c state of each stage when the stages are pulsed, only one stage will change its state for each input pulse, thereby providing progressive stage-by-stage counting. (AEC)

30645 RADIATION MONITORING. William Harrison Faulkner, Jr. and James E. Leone (to Laboratory for Electronics, Inc.). U. S. Patent 3,053,983. Sept. 11, 1962.

A compact film badge dosimeter is designed which gives an accurate indication of long-term cumulative dosage as well as short-term dosage. The badge has two film packets within a housing and overlapping each other, the overlapping areas being used as positive identification. The badge is constructed so that one film may be readily removed at weekly intervals for short-term dosage indication, while the second film can be removed only by disassembling the housing for cumulative dosage indication. (D.L.C.)

30646 IDENTIFICATION BADGE WITH DETACHABLE CLIP. Malachy T. Burns (to U. S. Atomic Energy Commission). U. S. Patent 3,054,201. Sept. 18, 1962.

The clip has a long slot with a round enlarged end, flat on one side. The badge has a headed member that is circular except for a flat side. The badge is connected to, or disconnected from, the clip by insertion of the headed member through the enlarged end of the slot in the clip. The badge is unlikely to be accidentally disconnected from the clip while being worn on a worker's clothing, because the weight of the badge keeps the headed member away from the enlarged end of the slot in the clip, and the headed member can pass through the enlarged end of the slot only at one relative angular position between badge and clip, namely, that angle at which the flat side of the headed member is coincident with the flat side of the enlarged end of the slot. (AEC)

30647 ELECTRON DISCHARGE DEVICE. M. H. Graham (to U. S. Atomic Energy Commission). U. S. Patent 3,054,926. Sept. 18, 1962.

A barrier-grid storage tube and an improved means for writing and reading of information in such a tube are described. A triax cable is provided in the reading and writing circuit and includes a coiled portion. The inner conductor of the cable is connected to the back plate of the barrier grid target assembly of the storage tube, the middle conductor of the cable is connected to a shielding member encompassing the target assembly and this member supports the barrier grid of the assembly, and the outer conductor of the cable is connected to an external shield surrounding the target assembly. A source of writing signals is connected between the inner conductor and middle conductor of said cable. Both the middle and outer conductors are connected to ground at the source end, and a small trimmer condenser is connected between the external shield and the source end of the inner conductor of the cable to compensate for the direct back plate-to-ground capacity due to the imperfect shielding of the barrier grid. The coiled portion of the cable provides for an output signal to a secondary coil coupled thereto. The grounded outer conductor serves as a means for preventing an output signal being applied to the coiled portion of the cable on application of writing signals to the inner and middle conductors of the cable. (AEC)

30648 DIODE STEERED MANGETIC-CORE MEMORY. A. S. Melmed, R. T. Shevlin, and R. Laupheimer (to U. S. Atomic Energy Commission). U. S. Patent 3,054,989. Sept. 18, 1962.

A word-arranged magnetic-core memory is designed for use in a digital computer utilizing the reverse or back current property of the semi-conductor diodes to restore the information in the memory after read-out. In order to ob-

tain a read-out signal from a magnetic core storage unit, it is necessary to change the states of some of the magnetic cores. In order to retain the information in the memory after read-out it is then necessary to provide a means to return the switched cores to their states before read-out. A rewrite driver passes a pulse back through each row of cores in which some switching has taken place. This pulse combines with the reverse current pulses of diodes for each column in which a core is switched during read-out to cause the particular cores to be switched back into their states prior to read-out. (AEC)

Materials Testing

30649 (UCRL-6243) MOBILE UNIT FOR NONDESTRUCTIVE TESTING IN THE FIELD. A. A. Wisgardie and J. K. Wheater (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 1960. Contract W-7405-eng-48. 10p.

A mobile nondestructive testing unit for radiographic testing of assemblies in the field is described. The unit is provided with an x-ray machine, portable Co^{60} and Cs^{137} energy sources, complete darkroom facilities, and equipment for detailed examination of radiograph films. (auth)

30650 FOR NONDESTRUCTIVE TESTING NEUTRON RADIOGRAPHY. Harold Berger (Argonne National Lab., Ill.). Nucleonics, 20: 77-81(Sept. 1962).

Thermal neutron radiography with photographic techniques are discussed. Direct-exposure and transfer methods are described. The best thicknesses of several metals in a double-screen technique are given, and photographic speeds and image sharpness are compared for various converter and screen combinations in the direct-exposure method. Gadolinium appears to be the best screen material. Neutron sources and image intensifiers are discussed. (D.L.C.)

30651 EVALUATION AND INSPECTION OF MATERIALS BY USE OF EDDY CURRENTS. Hugo L. Libby (General Electric Co., Richland, Wash.). Preprint Paper No. 21. New York, Engineers Joint Council, 1962. 26p.

Principles, equipment, instrument arrangements, and applications of eddy-current testing are surveyed. (A.G.W.)

30652 ULTRASONIC METHODS FOR EXAMINATION AND ACCEPTANCE OF COMPONENTS. Robert W. McClung (Oak Ridge National Lab., Tenn.). Preprint Paper No. 20. New York, Engineers Joint Council, 1962. 33p.

Theory and application of three categories of ultrasonic techniques, (1) reflection, (2) through transmission, and (3) resonance are discussed. It is concluded that the ultrasonic method is an essential part of nuclear nondestructive testing technology. (A.G.W.)

30653 DEVELOPMENT AND APPLICATION OF RADIOGRAPHIC TECHNIQUES. Gerold H. Teaney (Los Alamos Scientific Lab., N. Mex.). Preprint Paper No. 22. New York, Engineers Joint Council, 1962. 27p.

Both conventional film radiography and special techniques and their applications are reviewed. New and improved accessories and new techniques still in the development stage are discussed briefly. (A.G.W.)

30654 THE COMBINED APPLICATION OF ULTRASONIC METHOD AND GAMMA RAYS IN TESTING THE QUALITY OF CONCRETE IN BUILDING CONSTRUCTIONS. L. Brunarski, J. Basin, and R. Makarow. 13p. of "Pierwsze Krajowe Sympozjum Zastosowań Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

The possibility of applying a combination of ultrasonic and γ-ray methods in nondestructive testing of concrete constructions is discussed. The present classification of nondestructive physical methods of testing is given. The principles of the test combined method which depend upon an evaluation of the qualities of concrete used in construction and a comparison of the velocity of longitudinal ultrasonic waves in the concrete sample are described, the differences in the density of concrete in the sample and in the construction being considered. (OID)

30655 A METHOD OF TESTING APPLICABLE TO THE CONTROL OF THE MANUFACTURE OF COMPACTED BODIES OF MIXED MATERIAL OF DIFFERING ELECTRICAL CONDUCTING PROPERTIES. William Thompson and Harry Nowell (to United Kingdom Atomic Energy Authority). British Patent 904,212. Aug. 22, 1962.

An apparatus is designed for testing the homogeneity of compacted mixtures of two materials of differing electric conductivities, particularly Mg–UF_4 pellets for manufacture of U. The apparatus comprises means for supporting a differential transformer at two opposed sides of the compact, means for feeding a-c to the primary windings, and means for detecting the difference between the outputs of the secondary windings as an indication of the homogeneity of the compact. (D.L.C.)

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Refer also to abstract 30187.

30656 (HW-SA-2137) DUAL ATMOSPHERIC TRACER TECHNIQUES FOR DIFFUSION STUDIES USING PHOSPHORESCENCE-FLUORESCENCE ANALYSIS. J. D. Ludwick (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 20, 1961. Contract AT(45-1)-1350. 16p.

Analytical techniques were developed for the quantitative measurement of two tracers, zinc sulfide and fluorescein, used for atmospheric dispersion experiments. The zinc sulfide is determined by counting phosphorescence emission and the solution fluorescence of fluorescein is measured. The method permits simultaneous release of the tracers and collection on molecular air filters. The analytical technique was developed for use in studies of the effect of height of release on ground level dosage patterns. By releasing different tracer materials at two heights, the dosage patterns can be compared directly for the same meteorological conditions, thereby reducing the number of experiments required to obtain definitive measurements. Initially, the procedure required dissolution of the collection filter in an ethanol-ethyl acetate solvent. The zinc sulfide content was determined by light exposure followed by phosphorescence measurement in the dark. A sensitivity of about 5×10^{-9} grams was obtained. The solution was then centrifuged, and an aliquot removed and made basic with alcoholic potassium hydroxide. The fluorescein was then measured in a spectrofluorometer. Fluorescein was determined with a sensitivity of 1×10^{-9} grams. Cross interference is minimized using this technique and impurities of some 10^4 to 10^5 times the tracer being investigated can be tolerated. (auth)

30657 (IA-700) GAMMA RADIOACTIVITY MEASUREMENTS OF SOME ROCKS IN ISRAEL. E. Mazor (Israel. Atomic Energy Commission, Tel-Aviv). June 1962. 13p.

The results of a general gamma radiation field survey were used to obtain values for the specific gamma radiation of several rocks in Israel. The results confirm the well known phenomenon that the gamma radiation of magmatic rocks increases generally with the magmatic differentiation due to the increasing contents of uranium and thorium, and their decay products, and of potassium. In sedimentary rocks radiation was found to increase with clay content, because of accompanying potassium and uranium enrichment. Maximum values were detected in phosphatic laterites and in phosphorites, the latter containing up to 200 ppm uranium. (auth)

30658 (NP-12000) ON-SITE CAVITY LOCATION-SEISMIC PROFILING AT NEVADA TEST SITE. C. B. Forbes, R. A. Peterson, and C. L. Heald (United Electro-Dynamics, Inc., Pasadena, Calif.). Oct. 25, 1961. Project 7.4 of OPERATION BLANCA-RAINIER-LOLLIPOP. 146p.

Experimental seismic studies were conducted at the Nevada Test Site for the purpose of designing and evaluating the most promising seismic techniques for on-site inspection. Post-explosion seismic profiling was done in volcanic tuff in the vicinity of the Rainier and Blanca underground explosions. Pre-explosion seismic profiling was done over granitic rock outcrops in the Climax Stock area, and over tuff at proposed location for Linen and Orchid. Near surface velocity profiling techniques based on measurements of seismic time-distance curves gave evidence of disturbances in near surface rock velocities over the Rainier and Blanca sites. These disturbances appear to be related to near surface fracturing and spallation effects resulting from the reflection of the original intense compression wave pulse at the near surface as a tension pulse. Large tuned seismometer arrays were used for "horizontal seismic ranging" in an attempt to record "back-scattered" or reflected seismic waves from subsurface cavities or zones of rock fracturing around the underground explosions. Some possible seismic events were recorded from the near vicinities of the Rainier and Blanca sites. However, many more similar events were recorded from numerous other locations, presumably originating from naturally occurring underground geological features. No means was found for discriminating between artificial and natural events recorded by horizontal seismic ranging, and the results were, therefore, not immediately useful for inspection purposes. It is concluded that in some instances near surface velocity profiling methods may provide a useful tool in verifying the presence of spalled zones above underground nuclear explosion sites. In the case of horizontal seismic ranging it appears that successful application would require development of satisfactory means for recognition of and discrimination against seismic responses to naturally occurring geological features. It is further concluded that, although more sophisticated instrumentation systems can be conceived, the most promising returns for effort expended can be expected to come from increased experience, skill, and human ingenuity in applying existing techniques. The basic problem is in large part a geological one of differentiating seismic response to man made irregularities from that of natural features which are of a similar or greater size and universally proved. It would not appear realistic to consider the seismic tool as a proven routine device for giving clear answers in on-site inspection operations. Application must still be considered largely experimental. (auth)

30659 (NP-12031) A 7090 CODE FOR THE CALCULATION OF ELECTROMAGNETIC BLACKOUT FOLLOWING A HIGH ALTITUDE NUCLEAR DETONATION. P. G. Fischer, R. W. Hendrick, Jr., and R. H. Christian (General Electric Co. Technical Military Planning Operation, Santa Barbara, Calif.). Dec. 29, 1961. Contract DA49-146-XZ-038. 96p. (RM-61-TMP-96)

A program for computing the electron concentration and resulting electromagnetic absorption as functions of time, altitude, and range for specified detonation and debris histories is described. The computation includes initial ionization due to x and gamma rays, and neutrons and debris, as well as delayed ionization due to the continuing beta and gamma radiation from the debris. It computes the transient recombination and quasi-equilibrium solutions for electron concentration and the incremental electromagnetic wave absorption (decibels/kilometer) at the required altitudes for up to 3 specified electromagnetic wave frequencies. From these, the altitudes of specific electron concentration contours are interpolated and the one-way vertical absorption is obtained by trapezoidal integration. A modified control program to provide absorption from calculations along a given straight line is appended. The program is written in Fortran language for IBM-7090 and 704 computers. (P.C.H.)

30660 (NYO-2310) PHYSICS OF THE OCEAN. Reference No. 58-48. Arnold Arons and Bruce B. Benson

(Woods Hole Oceanographic Institution, Mass.). July 1958. Contract AT(30-1)-1794). 36p.

Status of work on instrumentation for the measurement of bottom pressure fluctuation in deep water and on the design of a seagoing scintillation counter is described. Mass spectrometric analyses of dissolved gases are reported for three North Atlantic Ocean stations — one in the Sargasso Sea, a second in the Gulf Stream, and the third in the slope water north of the Gulf Stream. Primary emphasis is on the development and testing of sampling and processing techniques. A strong O^{18} maximum is found in the neighborhood of the oxygen minimum as previously reported for Pacific Ocean stations by Rakestraw, Dole, and co-workers. In general, other increases and decreases in O_2 concentration are accompanied by simultaneous decreases and increases of O^{18} in the dissolved gas. Indications are obtained that the fractionation factors for O^{18} vs O^{16} are the same for both the surface and deep water masses at a given station but that the initial dissolved O_2 concentration of the two masses (i.e., the concentrations when the water was last in equilibrium with atmospheric air) are distinguishably different. A transition layer of 200 to 300 m. depth is discernible in terms of the oxygen isotope criterion. There is some evidence that the fractionation factor for the Sargasso station may be significantly different from that of the other two stations. Factors ranging in value from 1.013 to 1.041 are reported; these are substantially higher than the average value of 1.009 reported by Dole, et al., for four stations in the Pacific. Consideration is given to the interpretation of mass spectrometric data on dissolved nitrogen and argon. Small, perhaps insignificant, variations in N^{15}/N^{14} ratio are reported. (auth)

30661 (RME-140) HYDROGEOCHEMICAL RECONNAISSANCE FOR URANIUM IN THE STANLEY AREA, SOUTH-CENTRAL IDAHO. Chalres T. Ilisley (Grand Junction Office. Production Evaluation Div., AEC). July 1961. 21p.

Geochemical data obtained from the analyses of 73 water samples collected in the Stanley area, Idaho, demonstrate the applicability of hydrogeochemical techniques to uranium exploration. Uranium concentrations in surface waters of the area ranged from 0.2 to 22.0 ppb U_3O_8. The geometric mean for 27 samples from the Basin Creek mining area was 3.9 ppb U_3O_8, and the geometric mean for the remainder of the Stanley area was 1.1 ppb U_3O_8 (39 samples). Samples from seven hot springs averaged 0.3 ppb U_3O_8. The conductivity of the surface waters ranged from 45 to 350 micromhos, with the higher conductivities generally found in water from areas underlain by sedimentary rock. The pH of the surface waters varied only slightly from the average value of 7.4. Twelve of the most highly anomalous uranium concentrations in the Basin Creek district were found from 0.15 to 2 miles downstream from known uranium deposits. (auth)

30662 (TID-12409) WEATHER MODIFICATION. M. B. Rodin and D. C. Hess (Argonne National Lab., Ill.). Feb. 1961. Contract [W-31-109-Eng-38]. 4p. (UAC-4982)

A method is proposed to improve the distribution of rainfall by changing the flight pattern of rain clouds. Heat applied directly to a cloud will increase its buoyancy and its altitude. Depending upon the rate of heating, the increase in the altitude of the cloud may cause precipitation in an area where it would not normally occur or supress precipitation in an area where it would normally occur. In some cases the cloud will be dissipated. The costs and equipment necessary to heat the clouds are discussed. Two methods discussed are direct convection and remote infrared reflection. Emphasis is on using a reactor for the heating of the clouds. (N.W.R.)

30663 (TID-16336) STUDY OF TECHNIQUES FOR DETERMINING DISTRIBUTION OF RADIOACTIVE MATERIAL DEPOSITED IN THE UPPER ATMOSPHERE. Quarterly Status Report No. 1, March 19, 1962–June 19, 1962. (Geophysics Corp. of America, Bedford, Mass.). Contract AT(30-1)-2908. 28p.

Sodium trail drifts, although limited to morning and evening twilight give excellent wind resolution in the vertical. The mean magnitudes of the wind change from twilight to twilight (~12 hr) are presented for three sets of successive twilight data. The middle-latitude high atmosphere is seen to have a mean westerly flow (~40m/sec) from 80 to 112 km with easterly flow (~48m/sec) from 112 to 136 mk. The north-south flow is smaller (~20m/sec) and more variable with height. Superimposed upon this flow will be a variable flow which from one evening twilight to the following morning twilight experiences a large variation, which in the north-south flow, has nodal points at approximately 88 km, 102 km, and 114 km. The vertical distance which characterizes the velocity variation is of the same order as the atmospheric scale height. The problem of contaminant flux in a isothermal atmosphere under a gravitational force field is considered and settling times for the maximum concentrate surface are computed for two cases where the contaminants have specific masses of 1 and 101. (auth)

30664 (TID-16578(Pts. 1 & 2)) CAPTURE OF HYDROPHILIC AND HYDROPHOBIC PARTICLES BY CONDENSING AND EVAPORATING WATER DROPLETS. PART I. EXPERIMENTAL STUDY. J. Rosinski, J. Stockham, and J. M. Pierrard. PART II. THEORY AND ANALYSIS OF EXPERIMENTS. J. M. Pierrard (Illinois Inst. of Tech., Chicago. Armour Research Foundation). [1960]. Contract AT(11-1)-578. 43p.

A linear theory was developed for the motion of aerosol particles somewhat larger than a fluid mean free path in a non-stationary, nonuniform fluid. The special case of viscous flow around a condensing water drop was examined. The influence of fluid nonuniformity on the aerosol particle concentration gradient adjacent to the drop surface was evaluated from experimental data, as was the effect of particle wettability on capture efficiency. The capture efficiency of condensing and evaporating water droplets for airborne hydrophilic and hydrophobic ZnS particles of 1.1 micron diameter was determined experimentally for unit droplet Reynolds number and droplet radial growth rates from -22×10^{-5} to 2×10^{-4} cm/sec. Capture efficiencies for hydrophilic particles were greater by a factor of three to four than those for hydrophobic particles during droplet growth. (auth)

30665 (UCRL-6051) EFFECT OF LAYERING ABOVE A REFRACTOR ON THE CHARACTER OF THE REFRACTION ARRIVAL. Glenn C. Werth (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 20, 1960. Contract W-7405-eng-48. 16p.

The waveform or character of a refraction arrival has become important because of its use in determining source parameters. An approximate theoretical machine calculation was made to show the effect of layering above a refractor on the character of the refraction arrival. The method is illustrated with a geologic model taken from the Edwards Plateau area of West Texas. The effect of the Edwards limestone, Comanche, and Trinity formations on the refraction from the Pennsylvanian limestone is computed. The conversion of energy in these upper layers from

compressional to shear plays a significant role in forming the refraction character. An anticlinal structure is introduced into the Pennsylvanian limestone and it is argued that, in a first approximation, the wave in the Pennsylvanian limestone follows the structure, refracting off at the critical angle as before. Now, however, the angle of incidence on the base of the Trinity is a function of the angle of the structure. Since the amplitudes of converted waves depend on this angle, the character of the refraction arrival depends in a predictable way on the angle in the structure where the critical refraction has taken place. These results are theoretical and only approximate, but they point the way toward utilizing the character of a refraction arrival to deduce structure in the refractor. The work is considered to be a first step in the development of theoretical or synthetic seismograms for refraction prospecting. (auth)

30666 (UCRL-6306) A DIRECT METHOD FOR INVESTIGATING THE INTERIOR OF THE EARTH. Wm. Mansfield Adams (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 1961. Contract W-7405-eng-48. 13p.

Direct access to the crust and the upper portion of the mantle may be achieved by letting a high-temperature (>1100°C) reactor core melt the rock in which it is placed and fall through the resulting magma. Data gathering and retrieval seem feasible. A schematic design of the proposed instrument is given. (auth)

30667 THE SPACIAL AND GENETIC RELATIONSHIP BETWEEN EXOGENOUS AND SEDIMENTARY-METAMORPHIC URANIUM DEPOSITS, AND THE ARID ZONES OF THE RESPECTIVE GEOLOGIC EPOCHS. V. I. Krasnikov and Yu. V. Sharkov. Doklady Akad. Nauk S.S.S.R., 144: 1359-62 (June 1962) (In Russian)

The exogenous and sedimentary deposits of uranium show a clear relationship with arid zones of corresponding geological eras. Thus, many of the secondary uranium deposits of the Mesozoic-Cenozoic era in the western states of the U.S. are due to the favorable dry climatic conditions which prevailed in this region for millions of years. A semi-arid climate is a necessary condition for the concentration of uranium in the Tertiary deposits of Western Japan. An attempt is made to relate the formation of sedimentary uranium deposits of earlier ages to the paleoclimatic conditions reigning at the time. It is shown that dry or semi-arid conditions are required for the formation of secondary uranium deposits in all geological epochs. Under conditions of high humidity and a warm climate, uranium is rapidly leached from the soil. This process is slowed down considerably under arid conditions. Decaying vegation results in reducing conditions which tend to precipitate uranium. The low temperatures in the polar regions limit the migration of uranium. All the required conditions for the formation of exogenous uranium deposits exist in arid zones. These conditions are: a high rate of weathering and leaching of uranium, high mobility of uranium in the zone of hypergenesis, and favorable conditions for the precipitation of uranium from the leach water. This genetic relationship is of importance in discovering uranium, especially in deposits of older formations. (TTT)

30668 GAMMA FIELD DEFORMATION IN GROUND LEVEL ATMOSPHERE BY TREES. Yu. A. Izrael, R. M. Kogan, and Sh. D. Fridman (Inst. of Applied Geophysics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., No. 8, 1126-35(Aug. 1962). (In Russian)

Screening effects of a wooded area on local and extended γ-source fields at ground level were determined. The problem was resolved for the case of strong air doses. Radiation approximation and the anisotropic absorption properties of trees are considered in the calculation. (R.V.J.)

30669 PROSPECTING AND EXPLORATION RADIOMETRIC EQUIPMENT. A. L. Yakubovich. Moscow, Gosgeoltekhizdat, 1960. 205p.

The general principles of radiometric measurements and the design of equipment components are presented. Discussions are also given on portable prospecting and exploration instruments, instruments for prospecting in motion, core-sampling instruments, laboratory (ionization and scintillation) instruments, principles of radiometric equipment standardization, and statistical errors of measurement in radiometric equipment operations. (OID)

30670 APPARATUS FOR MEASURING MOISTURE OF SAND USING THE NEUTRON METHOD. M. Borowczyk. 8p. of "Pierwsze Krajowe Sympozjum Zastosowań Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

An apparatus (containing a Po–Be neutron source) for determining moisture content of sands is described. This apparatus was designed for logging cased boreholes >6 in. in dia and up to 100 m deep. The calibration curves obtained in boreholes of 6 and 8 in. in dia showed good differentiation for volume moisture below 45%. The absolute accuracy of the measurements was approx 1%. The apparatus, which can be adapted easily to logging deeper boreholes, was applied for measurements in engineering geology. (OID)

HEALTH AND SAFETY

Refer also to abstract 31313.

30671 (DPR/INF/269) SAFER THAN SAFE. A COMMENTARY ON STANDARDS OF RADIOLOGICAL PROTECTION. A. S. McLean (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch. Radiological Protection Div., Harwell, Berks, England). July 1962. 9p.

Data are summarized on the incidence of leukemia following radiation exposure. Standards of radiological protection are reviewed. The author concludes that the harm done by a few rems of exposure exists only in the minds of statisticians. The standards now followed in radiological protection are based upon exceedingly pessimistic predictions of the possible effects of exposure at very low rates to small doses of ionizing radiation. There are no grounds for collective or individual concern about the immediate or long-term effects of exposure within the present permissible limits. No further reduction in these limits should therefore be contemplated in the absence of adequate biological justification. (C.H.)

30672 (HW-SA-2000) CONTAMINATION CONTROL AT THE HANFORD REACTORS. S. L. Nelson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Sept. 1960]. Contract [AT(45-1)-1350]. 28p.

Small amounts of extremely fine particulate matter made up of various radioactive isotopes are associated with almost all maintenance and operational activities on the Hanford Reactors. In order to control the spread of this radioactive "contamination" and minimize its adverse effects, certain procedures and techniques were developed. In the main, they consist of: containment of the contamination within a restricted and controlled zone; decontamination through removal of the contamination by use of chemical solvents, mechanical action, or a combination of both; and fixing and/or covering and shielding the radioactive material. Success in contamination control depends largely upon adequate and timely detection and careful adherence to procedure. (auth)

30673 (HW-SA-2126) AN AUTOMATIC MONITORING STATION FOR THE COLUMBIA RIVER. T. C. Mehas (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 31, 1961. Contract [AT(45-1)-1350]. 9p.

A principal environmental monitoring program at the Hanford Atomic Products Operation is the determination of the radionuclide content in the Columbia River. Under normal operating conditions, small amounts of radionuclides are created in the coolant waters that pass through the plutonium production reactors and are then subsequently discharged into the Columbia River. The river below Hanford is used for a variety of purposes including sources of sanitary, irrigation, and industrial waters. In addition, it is a river which supports a large fish population and is used extensively for recreational purposes. The Automatic Columbia River Monitoring Station is a recent addition to the already broad program of river monitoring methods. As implied, the station is completely automatic in operation and requires only a routine inspection and maintenance. It provides a continuous recording of the river surface dose rate which serves as a determinant for potential external exposure and as an indicator of the actual concentration of radionuclides in the water. In alliance, a continuous measurement is made of the cumulate radiation dose encountered over the period of observation. This cumulative dose is, in turn, supplemented by an intermittent dose recording which allows the establishment of the radiation dose encountered for any given instrument of time within the observed period. Since the facility is unmanned, an alarm system has been incorporated to immediately signal the existence of any unusual radioactivity condition in the water or of any malfunctioning of the component equipment. The system also provides continuous river water samples for subsequent radionuclide analyses and the exact determination of radionuclide concentrations. Supplementing this sampling system is an emergency system which samples water during any abnormal conditions of relatively high activity. The station is located on the bank of the Columbia River at a point near the lower boundary of the Hanford Project. At this location, reactor effluents have achieved essentially uniform distribution in the river. The station location, 16 miles upstream from the nearest municipal water intake, allows an adequate time interval for evaluation or subsequent action that may be required commensurate with any unusual river conditions. A general view of the station interior is shown photographically. (auth)

30674 (HW-SA-2623) DISTRIBUTION OF PARTICLE SIZE FOUND IN BREATHING AIR AT HANFORD PLUTONIUM FABRICATION FACILITIES. J. M. Selby (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1962]. Contract [AT(45-1)-1350]. 14p.

Results from a study on the particle size distribution found in a Hanford plutonium fabrication facility are discussed. The data are related, where possible, to characteristic operations. (auth)

30675 (LADC-5370) RADIATION EXPOSURE TO PEOPLE FROM NUCLEAR WEAPON TESTS THROUGH 1961. H. W. Langham and E. C. Anderson (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 20p.

The present estimates of population exposure from long-range fall-out are summarized. Estimates of U. S. population 70-year exposures contributed by various components of fall-out from all tests prior to the moratorium (November 1958) and from the U.S.S.R. 1961 series are shown. Better quantitative definition of the following parameters has resulted in refinement and improved accuracy of average population exposure estimates: fall-out rate and integral surface deposition level as a function of point of stratospheric injection, dependence of dietary level on differential and integral fall-out, and dietary and metabolic factors. (N.W.R.)

30676 (NP-12016) MODELING TECHNIQUES AS APPLIED TO FALLOUT SIMULATION ON RESIDENTIAL-TYPE STRUCTURES AND SOME PRELIMINARY RESULTS. Albert W. Starbird, John E. Batter, Jr., and Herbert A. Mehlhorn (Technical Operations, Inc., Burlington, Mass.). July 8, 1961. Contract CDM-SR-60-45. 97p. (TO-B-61-35)

An experimental study was made of the radiation attenuation of two residential-type structures. The two model structures investigated were surrounded with rings and annular areas of simulated fall-out by pumping a 10-curie, cobalt-60 source through plastic tubing at a constant velocity. Radiation measurements were taken with time-integrating detectors. The theory of measuring radiation

effects with models is discussed and the facility developed for OCDM at Technical Operations, Incorporated, Burlington, Massachusetts, to conduct these experiments is described. A comparison is made of experimental data obtained in these tests with data obtained in previous full-scale tests made on identical structures at the Nevada Test Site. (auth)

30677 (NP-12019) UMWELTRADIOAKTIVITÄT UND STRAHLENBELASTUNG. (Environmental Radioactivity and Radiation Burden). (Germany. Bundesministerium für Atomkernenergie, Bad Godesberg). 1961. 78p.

Data are reported on the content of radioactive matter in air, water, ground, and foodstuffs and the radiation burden of the population in the Federal Republic of Germany (Western section) up to 1962. (tr-auth)

30678 (ORNL-3319) NUCLEAR SAFETY PROGRAM SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1962. (Oak Ridge National Lab., Tenn.). Aug. 24, 1962. Contract W-7405-eng-26. 81p.

Progress in nuclear safety research and development is reported. Topics covered include: reactivity effects of fuel displacements in a pool-type reactor, release of fission products on out-of-pile melting of reactor fuels, release of fission products on in-pile melting of reactor fuels, fission product transport evaluations, characterization and control of accident-released fission products, nuclear safety pilot plant, preparation of reactor containment handbook, and radiochemical plant safety studies. (M.C.G.)

30679 (TID-11461) LABORATORY COMPRESSED GASES—HANDLING AND STORAGE. Ellis L. Stout (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-36]. 8p. (LADC-4508)

The handling and storage of compressed gas cylinders are considered. It is shown that hazards (explosion, fire, health, and pressure) associated with compressed gas cylinders depend not only on the character of the gas but how it is used. The chemical and physical properties of 51 gases used in laboratories are presented as a guide to safety in their use. (N.W.R.)

30680 (TID-16457) GAMMA RAY EXPOSURE DOSE TO NON-URBAN POPULATIONS FROM THE SURFACE DEPOSITION OF NUCLEAR TEST FALLOUT. H. A. Knapp (Division of Biology and Medicine. Fallout Studies Branch, AEC). July 1, 1962. 53p.

It is tentatively concluded that for the first year following deposition of fall-out, the average external gamma dose to the non-urban population of the U. S. lies between $^{3}/_{10}$ths and $^{5}/_{10}$ths of the infinite plane dose, and that the average open field dose is $^{3}/_{4}$ths the infinite plane dose. The distribution of dose to a non-urban population in a uniformly contaminated area is estimated to be approximated by a lognormal distribution in such a way that $^{1}/_{6}$th of the population receives at least 1.7 times the average dose. It is concluded that weathering makes no appreciable reduction in the open field dose rate for about a year, and that for several years thereafter the open field dose rate would not be reduced by more than 30% from this effect. (auth)

30681 (TID-16562) A COMPUTER PROGRAM FOR EVALUATING RADIOLOGICAL HAZARDS RESULTING FROM THE ATMOSPHERIC RELEASE OF RADIONUCLIDES FROM A REACTOR (thesis). William Edward Haddican (Washington. Univ., Seattle). 1962. 60p.

The development and utilization of a computer program that will evaluate the immediate radiological hazards resulting from the accidental atmospheric release of radionuclides from a reactor is discussed. The program provides for the computation of the magnitude of deposition, location of the point of maximum deposition, areas of isopleths as a function of location in the field of exposure, and the definition of the location of the isopleths. It also provides for the computation of the dose from airborne radionuclides, inhaled dose, and exposure dose rate from deposited radionuclides. Where it is convenient, data indicates the nature and magnitude of the residual radiological hazards that can be minimized by effective controls. The program is written for an IBM-709 computer in the Fortran system. (P.C.H.)

30682 (UCRL-6936) HAZARDS CONTROL QUARTERLY REPORT NO. 8, JANUARY–MARCH 1962. (California. Univ., Livermore. Lawrence Radiation Lab.). Contract W-7405-eng-48. 45p.

Developmental work is described in which techniques were evolved for determining inward air leak rates of inert atmosphere glove boxes. In investigation of pressure drop across an idle blow it was found that manifold capacity can be lost to the resistance of an idle, series-connected blower. Assembly of a high-volume air sampler is reported along with addition of 135- and 225-cfm high-efficiency filters to the LRL stock. Development of an increased-sensitivity gas monitor is reported. Studies of Pu^{238} dosimetry revealed that measurement of radiation from this isotope requires pulse-height analysis to determine the effective energy when the spectrum is significantly modified. Collection and analysis of tetranitromethane in air is descirbed. Other safety developments during the period concern emergency protective clothing kits, ladder prong guards, fire hydrant flow data reduction, fire hydrant retardant coatings, antislip floors, chemical resistant polyester coatings, packaging of alpha- and beta-contaminated waste, and application of automatic data processing in hazards control. (J.R.D.)

30683 (USNRDL-ER-12) EVALUATION OF RADIOLOGICAL TRAINER DEVICE X11F3. E. J. Leahy and J. R. DePew (Naval Radiological Defense Lab., San Francisco). Dec. 19, 1961. 53p. (AD-270740)

The Radiological Trainer is a portable unit used to spread a radioactive solution of Br^{82} over any surface. It is to be used for training personnel in radiation and contamination control procedures. Radiological problems resulting from an accident involving radioactive materials or a nuclear weapon detonation can be simulated. Gamma dose rates of 100 mr/hr at 3 ft from the surface may be produced over areas up to 5000 ft^2. With proper precautions, the training can be conducted without exceeding the limitations set forth in Standards for Protection Against Radiation. (auth)

30684 (JPRS-14974) SELECTIONS FROM HYGIENE AND SANITATION. Translation of Gigiena i Sanitariya, 27: No. 4, 18-24; 56-60; 67-71-88-90(1962). 31p.

Translations are presented of selected articles from the Russian language periodical Gigiena i Sanitariya, 27: No. 4, 1962. Separate abstracts were prepared for 3 articles. Other articles translated are The Effect of Acclimatization to Cold on the Skin Analyzer and The Question of Physical Hygienic Evaluation of Pulse Oscillations. (C.H.)

30685 (JPRS-14974(p.10-15)) HYGIENIC STANDARDS FOR WORK WITH RADIOACTIVE SUBSTANCES IN PUBLIC HEALTH INSTITUTIONS. E. (Ye.) I. Vorob'ev (Vorob'yev) and P. I. Moiseitsev (Moiseytsev). Translated from Gigiena i Sanit., 27: No. 4, 56-60(1962).

New safety standards for radiology departments and laboratories using radiation in the U.S.S.R. were approved in 1961. The standards are obligatory in the planning and

construction of all new facilities as well as in remodeling and using those already in existence. The new standards are discussed. (C.H.)

30686 (JPRS-14974(p.16-19)) LOWERING OF THE RADIOACTIVITY OF WATER CONTAMINATED BY Sr-89 WITH CERTAIN HYDROBIONTS AND SILT. G. D. Lebedeva. Translated from Gigiena i Sanit., 27: No. 4, 88-90 (1962).

Laboratory studies were made on the effectiveness of various aquatic organisms and silts on the removal of Sr^{89} from water in a simulated fresh-water reservoir. The influence of temperature and light on the accumulation of Sr^{89} by the aquatic organisms was also studied. The organisms studied included algae, Scenedesmus quadricauda, Daphnia magna, and mollusks, Unio pictorum. Results showed that, under the experimental conditions used, the concentration of Sr^{89} in the water was reduced by 80 to 88% by massive growth of algae. (C.H.)

30687 (JPRS-14974(p.28-30)) THE GAMMA BACKGROUND OF THE COAST AND CERTAIN REGIONS OF THE BARENTS SEA. A. F. Fedorov and V. S. Zlobin. Translated from Gigiena i Sanit., 27: No. 4, 90-1(1962).

The gamma radioactivity of air and sea water was measured at various locations along the shore of the Barents Sea. (C.H.)

30688 THE RADIATION ENERGY ABSORBED BY THE HUMAN BODY DURING THE INHALATION OF AIR AND INGESTION OF WATER ENRICHED WITH RADON. S. V. Andreev (Central Inst. of Physiotherapy, USSR). Med. Radiol., 7: No. 8, 40-6(Aug. 1962). (In Russian)

Experimental data are presented. The results show that during inhalation of air enriched with radon it is quite feasible to measure the radiation energy absorbed by the organism as a result of radon breakup and daughter products in the blood. (auth)

30689 BASIS FOR MAXIMUM PERMISSIBLE LEVELS OF RADIOISOTOPE UPTAKE BY AN ORGANISM. Yu. I. Moskalev. Med. Radiol., 7: No. 8, 91-7(Aug. 1962). (In Russian)

Experimental data on permissible levels of radioisotope incorporation in human organisms are analyzed using as a criterion the life expectancy in animals and osteosarcomogenic and leukomogenic effects of radioisotopes in animals and men. (R.V.J.)

30690 HAZARDS INVOLVED IN PROCESSING RARE EARTHS. J. Sýkora, F. Hůzl, and A. Kubát. Pracovní lékařství, 14: 271-7(1962). (In Czech)

The working hazard involved in the production of technical products from rare earths is discussed. Particular attention is paid to cerium fluoride and cerium oxide. The hazard of hydrofluoric acid and chlorine which are liberated during technological processing, is mentioned. Particular attention is, however, paid to the hazard of the commonly encountered admixture of radioactive thorium and its breakdown products, which are found as constant impurities of these compounds. The activity of the raw materials, products, and dust obtained at different localities of the working place is estimated. The greatest hazard of internal contamination during cleaning of filter presses and grinding of cerium fluoride. During preventive examinations, all tests are necessary, if there is a hazard of ionizing radiation and fluoride, and as regards sanitary conclusions, it is emphasized in particular the need to insulate filtration equipment and to introduce a special working regimen including examinations of internal contamination and intensity of external radiation. (auth)

30691 NEVADA TEST FALLOUT AND RADIOIODINE IN MILK. Ralph E. Lapp. Science, 137: 756-8(Sept. 7, 1962).

The I^{131} dosage to infant thyroids as a result of Nevada testing is evaluated. The case of heavy fallout in the Troy, N. Y., area on 26 April 1953 is cited. The possibility is discussed that a thyroid cancer survey would provide a critical test of linear response versus threshold theory for radiation injury to tissue. (auth)

30692 AN EVALUATION OF RADIATION PROTECTION STANDARDS FOR INDIAN CONDITIONS. K. Venkataraman, S. Somasundaram, and S. D. Soman (Atomic Energy Establishment, Trombay, India). Prepublication Copy. 13p.

Standards for protection against external and internal exposures to ionizing radiation recommended by the International Commission on Radiological Protection were tentatively adopted by Atomic Energy Establishment Trombay. Since no generally acceptable limits were prescribed for contamination of surfaces, attempts were made to develop such standards in the light of Indian conditions. This work has shown that in view of Indian food and eating habits, surface contamination limits will have to be much more rigorous than those used in establishments in UK and USA. Work was then undertaken to determine the characteristics of a normal Indian adult such as total body weight, weights of individual body organs, and daily water and air intake in order to compare these values with those of the ICRP Standard Man. From data obtained so far, it is indicated that maximum permissible body burden values may require a downward revision for some radionuclides by a factor of about 1.5 and that MPC_w values may have to be lowered by a factor of about 3. Further studies are in progress. (auth)

30693 RADIOLOGICAL HEALTH DATA, MONTHLY REPORT, VOLUME III, NUMBER 6. (Public Health Service, Washington, D. C.). June 1962. 42p. $0.50(GPO).

Data are tabulated on the gross β activity in samples of air and precipitation collected at sampling stations throughout the U. S. in March 1962. Measurements were made of surface air radon, thoron, and fission product gross β concentrations in surface air at Cincinnati, Ohio, during Feb. and March 1962 and of gross β activity in surface air near the 80th Meridian West. Data are tabulated on the radioactivity of raw agricultural products exposed to fall-out, and of samples of milk and surface waters. Selected foods, representing 19 food categories incorporated in the average diet at three locations, were analyzed for Sr^{90} content during Aug., Sept., and Oct. 1961. Data are included on the radioactivity of water supplies in the area of the Nevada Test Site, external γ activity at selected sites, and environmental levels of radioactivity at Brookhaven National Laboratory, Mound Laboratory, and the National Reactor Testing Station during the third and fourth quarters of 1961. Data is tabulated on I^{131} concentration in human thyroid glands examined during the last quarter of 1961. (C.H.)

30694 RADIOLOGICAL HEALTH DATA. VOLUME III, NUMBER 8. (Public Health Service, Washington, D. C.). Aug. 1962. 50p. $0.50(GPO).

Data are presented on radioactivity in samples of air, precipitation, food, milk, drinking water, and surface water collected at various locations during the first half of 1962. Data are tabulated on Cs^{137} in human subjects measured in whole-body counters located in Washington, D. C., and in Landstuhl, Germany. Environmental levels of radioactivity were measured at AEC installations near Carlsbad, New Mexico, Paducah, Ky., and Canoga Park, Calif. A list is included of reported nuclear detonations during July 1962. (C.H.)

30695 DEVELOPMENT AND DESIGN OF OFF-SITE FISSION PRODUCT SHIPPING CASKS AT HANFORD. C. Wesley Smith (General Electric Co., Richland, Wash.). Preprint Paper No. 16. New York, Engineers Joint Council, 1962. 28p. (HW-SA-2295)

Two casks were designed for shipping fission products as stable, dried solids, one for Ce^{144} and one for Sr^{90}. One of these was modified to permit shipping Sr^{90} adsorbed on an inorganic ion-exchange material. All casks were designed to withstand impact at 44 fps followed by either loss of heat dissipation for 48 hr or immersion in a fire for 2 hr. All casks use Wood's metal for the primary coolant and all have a sufficient thickness of Pb shielding to reduce radiation to the levels required by the ICC. An external cask container is used to absorb impact energy. (A.G.W.)

30696 JOHN Q. PUBLIC VS. IONIZING RADIATION. R. T. Waite (AEtna Casualty & Surety Co., Hartford, Conn.). Preprint Paper No. 37. New York, Engineers Joint Council, 1962. 15p.

The current general attitude of the public toward the nuclear industry and the possible effects of radiation is discussed. Insurance programs applicable to owners and operators of nuclear facilities are described. The importance of safety in nuclear installations is stressed. (A.G.W.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstract 31231.

30697 (DPR/INF/268) ACCURATE MEASUREMENT OF TURBULENT FLOW IN PIPES USING RADIOACTIVE ISOTOPES. C. G. Clayton (United Kingdom Atomic Energy Authority. Research Group. Isotope Research Div., Wantage, Berks, England and United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). June 1962. 15p.

Methods using radioactive isotopes for the measurement of large water flow rates have now been developed to a stage where they are convenient and reliable to an accuracy of 1 per cent or less. The development of isotope dilution and velocity methods are discussed. (C.H.)

30698 (JLI-650-9-1) HIGH DILUTION ON-STREAM ISOTOPIC TRACERS. Annual Report. (Johnston (William H.) Labs., Inc., Baltimore). May 1961. Contract AT(11-1)-650. 206p.

Research and development in various aspects of tracer studies in rivers and streams and low-level isotopic tracer technology are summarized. Studies include the development and evaluation of principles, instrumentation, techniques, and applications. Emphasis was directed toward the broad field of water resources and the related problems of pollution. Stream pollution and river tracer studies, water quality and the problem of odor and taste, oceanography and new applications for isotopes, and development of methods and instruments are discussed. (M.C.G.)

30699 (NP-12056) RADIOISOTOPES IN RADIATION PROCESSED FOODS, SEPTEMBER 16, 1961–MARCH 15, 1962. George R. Meneely (Vanderbilt Univ., Nashville. School of Medicine). Contract DA-49-193-MD-2101. 22p.

No significant differences were found in the K^{40} and Cs^{137} content of Co^{60} irradiated and non-irradiated canned ham. Since there is no significant increase in activity in the irradiated ham over the non-irradiated, it is assumed that irradiated ham has no induced activity. Data are tabulated from the analysis of Co^{60} irradiated canned chicken, bacon, and beef for induced radioactivity. (C.H.)

30700 THE INTERACTION OF MARTITE AND MAGNETITE WITH SODIUM OLEATE AT VARIOUS pH VALUES. F. N. Belash and A. I. Andreeva (Krivorozhskii Mining Inst., USSR). Doklady Akad. Nauk S.S.S.R., 145: 615-6 (July 21, 1962). (In Russian)

The amount of sodium oleate adsorbed by martite and magnetite was determined by beta counting the radioactive C^{14} in the tagged sodium oleate. When the pH was adjusted before addition of the collector (50 mg/l), maximum absorption of the sodium oleate was observed at a pH of 6.0 to 7.2. If the mineral powder was treated with sodium oleate before adjustment of the pH, strong absorption of the collector on the iron oxide surface was observed from a pH of 2.5 to 7.0. Maximum flotation was obtained at a pH of 6.0 to 7.2, when the pH of the mineral slurry was first regulated, and then the collector was added. In an alkaline medium the hydroxide ions displaced the sodium oleate from the surface of the mineral. Adsorption in the form of oleic acid took place on the acid. Flotation was observed with absorption of oleic acid when an acid foaming agent was added. On treating the mineral with the sodium oleate collector in an acid medium before adjustment of pH, the oleic acid was not desorbed from the oxide surface, and flotation occurred over a wide range of pH from 2.5 to 7.2. Since sodium oleate was partially described from quartz on increasing the acidity of the medium, good selectivity was obtained by adding the mineral acid after the collector on flotation of the iron oxides in a weakly acid medium. (TTT)

ISOTOPE SEPARATION

30701 (K-1537) MACHINE CALCULATION OF CENTRIFUGE EFFICIENCIES. A. A. Brooks (Oak Ridge Gaseous Diffusion Plant, Tenn.). Sept. 21, 1962. Contract W-7405-Eng-26. 27p.

An IBM-7090 computer program was written in Fortran to perform calculations necessary to the application of a recently developed centrifuge separation theory. Minimum instructions necessary to the use of the program and to the understanding of the program output are presented. In addition, a description of the Fortran program itself and a program listing are given. (auth)

30702 SEPARATION OF LITHIUM ISOTOPES ON THE AMBERLITE IR-120 CATION EXCHANGER. M. M. Ćirić and J. D. Pupezin. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13, No. 2, 29-45(July 1962). (In English)

The concentration dependence of the elementary separation factor for different lithium compounds ($LiNO_3$, LiCl, Li_2SO_4, CH_3COOLi, and LiOH) was investigated on the Amberlite IR-120 cation exchanger. The elementary separation factors were determined by the method of breakthrough curves. The isotopic analysis was made on a double-collector mass spectrometer. The standard error of relative measurements of the Li^7/Li^6 ratio was about 0.1%. Depending on the concentration and anions, the elementary separation factor varied from 1.019 to 0.999, taking into account the enrichment of Li^7 in the solution. Distinct maxima at the concentration 2N (1.019 and 1.014, resp.) were found for solutions of chlorides and nitrates. Minima appeared at the concentrations 3N and 4N with factors 1.007 and 0.999, respectively. The addition of organic solvents to the solutions of lithium salts considerably decreased the separation parameter $|\alpha - 1|$. The results were considered to be connected with the formation of ion pairs and similar associates in solutions of strong electrolytes. (auth)

30703 EQUILIBRIUM CONSTANT FOR BORON ISOTOPE EXCHANGE BETWEEN BF_3 AND $BF_3 \cdot O(CH_3)_2$. A. A. Palko, G. M. Begun, and L. Landau (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 37: 552-5(Aug. 1, 1962).

The isotopic equilibrium constant for boron exchange between BF_3 and $BF_3 \cdot O(CH_3)_2$ was measured at −8, 4, and 22°C. The measured values are compared with values calculated from infrared and Raman spectral data. The physical basis for boron isotope fractionation in systems of this type is discussed. (auth)

30704 THE PRESSURE DIFFERENCE IN SATURATED Kr AND Xe VAPORS. V. N. Grigor'ev (Inst. of Physics and Technology, Academy of Sciences, Ukrainian SSR). Zhur. Fiz. Khim., 36: 1779-81(Aug. 1962). (In Russian)

The relative pressure difference in saturated Kr and Xe vapors was found by means of rectification. At the boiling point and atmospheric pressure the vapor pressure $(\Delta p/p)$ of Kr^{82} and Kr^{86} is 4.7×10^{-4} and of Xe^{130} and Xe^{136} it is 10^{-4}. (R.V.J.)

MATHEMATICS AND COMPUTERS

Refer also to abstracts 30647, 30648, and 31199.

30705 (AECL-1565) "EDAC" AN ELECTRONIC DATA ANALYZING CENTRE FOR NUCLEAR PHYSICS RESEARCH. J. Leng (Atomic Energy of Canada Ltd., Chalk River, Ont.). July 18, 1962. 18p.

The analyzing equipment associated with the Chalk River Tandem Van de Graaff accelerator is being extended into a large data-analyzing center available for concurrent use by several major experimental facilities within the Physics Division. The use of the 900-channel multidimensional pulse analyzer has extended the scope of nuclear physics experiments considerably. This will be further extended by the addition of a magnetic-tape recording system to the analyzer. Analyzing capacity using magnetic-core storage is to be increased by 8,192 channels and will be capable of accepting data at a mean rate of 10^5 events per second. A number of experiments may concurrently use separate portions of this analyzer provided that the total counting rate does not exceed this maximum. A high-speed digital computer is to be connected directly to this and other analyzers so that immediate and precise assessments of the accumulating data will be possible. The computer will also find use in the automatic control of routine data gathering and as an aid to the operation of the Tandem Van de Graaff. (auth)

30706 (AHOD-407:59) MOTION OF A NON-CONDUCTING SPHERE THROUGH A CONDUCTING FLUID IN THE PRESENCE OF A MAGNETIC FIELD. Interim Technical Report No. 49. M. P. Singh (Maryland. Univ., College Park). [1961]. Contract DA-36-034-ORD-1486. 28p.

A sphere moving with uniform velocity, after an impulsive start along the x direction, was considered. The problem for impulsive start along the z direction was treated earlier and so generalization to an arbitrary direction was immediate. The restriction to a sphere may be removed; however, the integral equations which result may not be solvable in general. Nevertheless, the general features of the flow may be deduced from the solution for the sphere. (auth)

30707 (HW-70893) A GENERALIZED FORTRAN INPUT ROUTINE. J. R. Lilley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 29, 1961. Contract AT(45-1)-1350. 11p.

Subroutine INPUT, and the subsidiary subroutine LISTIN, offer an opportunity to standardize the input formats on most, if not all, FORTRAN programs. The generalized input routine originally read only data stored in COMMON; it was extended so that it may be used to read any data. COMMON data input preparation, data input to absolute locations, data input to relocatable locations, programming to use the input routine, and making up input instructions are discussed and examples are given. (M.C.G.)

30708 (HW-SA-2056) LOLA—A MULTI-DIMENSIONAL OPTIMIZATION CODE FOR THE IBM 709-7090. M. R. Egan (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 18, 1960. Contract [AT(45-1)-1350]. 4p.

The LOLA code provides an optimization technique for handling analytical or empirical systems composed of a large number of variable parameters. The plan used is described. (M.C.G.)

30709 (HW-SA-2067) EXTENDED USE OF HILL'S INFINITE DETERMINANT. Albert L. Ruiz (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 15, 1960. Contract AT(45-1)-1350. 19p.

An infinite determinant is sometimes used in studying the stability of solutions of Hill's differential equation. A discussion is presented in which it is shown how this method may be extended to more general types of equations. (J.R.D.)

30710 (KAPL-M-EC-23) MIRAGE—MATRIX INTERPRETIVE ROUTINE. D. G. Dight, F. D. Federighi, and J. A. Warrington (Knolls Atomic Power Lab., Schenectady, N. Y.). July 25, 1962. Contract W-31-109-eng-52. 27p.

MIRAGE is a system of matrix operations which proceed sequentially as directed by input instructions. Over 20 different types of matrix operations are included in this program. The program is limited to real matrices. The maximum dimension for any matrix is 54 (i.e., 54×54 is permitted but 55×1 is not). The running time depends on the number and type of matrix operations being performed and the order (N) of the matrices being manipulated. The maximum time for any one instruction operating on a 54×54 matrix is 3 sec. The average running time may be approximated by the formula $T(\text{hrs}) \cong 5.0 \times 10^{-6} N^2 \times$ no. of instructions. (auth)

30711 (KAPL-M-EC-25) CURFIT-2—CURVE FITTING PROGRAM. James A. Warrington (Knolls Atomic Power Lab., Schenectady, N. Y.). Aug. 6, 1962. Contract W-31-109-eng-52. 74p.

CURFIT-2 is a digital computer program which is a composite made up of several different curve fitting methods in one package. For the convenience of the user, options were included to allow various input formats and methods of weighting. The fitting methods included in this program are: polynomial ($Y = \Sigma_{i=0}^{n} a_i x^i$, $n \leq 10$) for up to 300 points; exponential ($Y = ae^{bx}$) for up to 300 points; cosine ($Y = a \cos b(x + c)$) for up to 300 points; system of linear equations ($Y = \Sigma_{i=1}^{n} a_i x_i$) up to 200 equations, 50 unknowns; series of cubics ($Y = a_j + b_j x + c_j x^2 + d_j x^3$—j according to x) for up to 50 points; and Fourier Series; $Y = \frac{1}{2} a_0 + \Sigma_{i=1}^{n} [a_i \cos \ldots$ etc.]. The input is supplied as the coordinate points describing the curve to be fitted. The program running time for each case should not exceed more than one minute. (auth)

30712 (KAPL-M-JA-6(Rev.IV)) KARE INPUT. Revision IV. J. A. Archibald, Jr., and J. L. Fletcher (Knolls Atomic Power Lab., Schenectady, N. Y.). Aug. 15, 1962. Contract W-31-109-eng-52. 131p.

KARE input is punched on cards for use on the off-line card-to-tape converter. The resulting tape forms the actual on-line input for the running of KARE problems. The scope of KARE and its specifications, general input, boundary input, increment input, and region dependent input are discussed. (M.C.G.)

30713 (TID-11268) DETERMINATION OF CORRELATED QUANTITIES FROM EMPIRICAL DATA BY A MONTE CARLO PROCESS. C. E. Abraham and W. H. Bradford (Sandia Corp., Albuquerque, N. Mex.). [Oct. 12, 1959]. Contract [AT(29-1)-789]. 11p. (SCDC-922)

A method, involving Monte Carlo processes and the multivariate normal distribution, was derived for generating n correlated quantities from n correlation coefficients obtained from empirical or experimental data.

Although reference is made to wind velocity component correlations, other physical quantities may be correlated in the same manner. A major source of difficulty is that the noncircular definition of lag correlations in the case of stationary time series may not produce a positive definite variance-covariance matrix for the multivariate normal distribution. Two schemes are considered for modifying lag correlations, within the limits of experimental error, to obtain a positive definite variance-covariance matrix. (auth)

30714 (UCRL-6226) CLOSED EXTENSIONS OF THE LAPLACE OPERATOR DETERMINED BY A GENERAL CLASS OF BOUNDARY CONDITIONS. W. G. Bade and R. S. Freeman (California. Univ., Livermore. Lawrence Radiation Lab. and California. Univ., Berkeley. Lawrence Radiation Lab.). Dec. 1960. Contract W-7405-eng-48. 27p.

The spectral theory of closed operators in Hilbert space determined by the Laplace operator and certain general boundary conditions is considered. Using the method of J. W. Calkin, the case of a bounded domain in E^m with $C^{1,1}$ boundary was treated, and the method was extended to cover the case for which the operator L in the boundary condition is not necessarily self-adjoint. It is shown that there exists an appropriate linear class of functions $D_1(G) \subseteq L_2(G)$ such that the operator S in the Hilbert space $L_2(G) \oplus L_2(\partial G)$ with domain $D(S) = \{[u,\tilde{u}] | u \in D_1(G)\}$ and $S[u,\tilde{u}] = [-\Delta u, \tilde{u}_n]$, $u \in D_1(G)$, is self-adjoint. Here $\tilde{u}$ and $\tilde{u}$ are the values of u and ∂u $\overline{\partial n}$ on ∂G. If L is an arbitrary (not necessarily self-adjoint) bounded operator in $L_2(G)$, then the operator $T_L = -\Delta$ on the domain $D(T_L) = \{u \in D_1(G) | \tilde{u} = L\tilde{u}\}$ is closed, and T_L^* is equal to T_{L^*}. It is shown that the spectrum of T_L is discrete and is contained in a parabola with horizontal axis, and opening to the right. One of the aims of the work is a precise determination of $D_1(G)$. It consists of the class of functions in the domain of the maximal operator associated with $-\Delta$ such that u and $\partial u/\partial n$ have L_2 boundary values. In potential theoretic terms it is the set of all sums $p + h$, where p is the potential due to a charge g in G and h is a potential due to a surface charge f on ∂G, where g and f are, respectively, square integrable over G and ∂G. (auth)

30715 (UCRL-6260) THE SOLUTION OF THE SIMPLEST CENTERED DIFFERENCE APPROXIMATION TO POISSON'S DIFFERENTIAL EQUATION FOR A RECTANGULAR GRID OF EQUALLY SPACED POINTS. Richard E. von Holdt (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 22, 1960. 17p.

The compound matrix corresponding to Poisson's Differential Equation is simplified by a similarity transformation which diagonalizes the diagonal elements and leaves the off-diagonal elements invariant. A further similarity transformation, which is only a permutation, transforms the matrix into a diagonal compound matrix whose elements are triple-diagonal matrices. (auth)

30716 (UCRL-6272) CLOSED EXTENSIONS OF THE LAPLACE OPERATOR DETERMINED BY A GENERAL CLASS OF BOUNDARY CONDITIONS, FOR UNBOUNDED REGIONS. Robert S. Freeman (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 6, 1961. Contract W-7405-eng-48. 24p.

A discussion is presented in which the Laplacian is considered as an operator on $L^2(G)$ where G is not necessarily a bounded domain in n-dimensional Euclidean space. It is shown that with its domain restricted by boundary conditions of the form $(\partial u/\partial n) - Lu = 0$ the Laplacian defines a closed linear operator, T_L, whose adjoint T_L^* is just the Laplacian restricted by the boundary condition $(\partial u/\partial n) - L^*u = 0$, i.e., $T_L^* = T_{L^*}$. If ∂G is bounded, L may be an arbitrary bounded linear operator on $L^2(\partial G)$ and it is shown that the spectrum of T_L lies in a parabolic region opening to the right. If ∂G is unbounded, then L is restricted to being multiplication by a bounded function. (auth)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

30717 (ANL-6516) METALLURGY DIVISION ANNUAL REPORT FOR 1961. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 425p.

Development and Fabrication Programs for EBR II. Determinations of the total heat content, including heats of transformation and fusion, of U and U-fissium alloys were completed during the year. Data are also included on cladding penetration by molten U-fissium alloys and molten Pu fuel. Irradiation studies of U-fissium and U-fissium-Zr alloys were conducted. Progress is reported on the development of methods and equipment for remote refabrication of EBR-II fuel. Development and Fabrication of EBR-I Core IV Fuel Elements. A program to investigate methods of fabricating Pu-Al reference alloy for EBR-I Core IV is described along with the production of fuel rods for this core. The procurement, fabrication, and inspection of components other than Pu material for Core IV of EBR-I was continued. Data obtained in nondestructive inspection of EBR-I Core IV components are presented along with data concerning properties of and radiation effects on Al-Pu alloys. EBWR Fabrication Programs. The work in these programs was largely concerned with fabrication of a control-rod-drive assembly made of 17-4 PH stainless steel. Fabrication of Borax-V Boiling and Superheater Fuel Elements, Control Rod Drive Shafts, and Control Rods. Data are given on fabrication and evaluation of Borax-V superheat fuel elements. Information on new extension shafts for Borax-V control rod drives and on Borax-V control rods is included. Fabrication of Converter Plates for JANUS Biology Reactor. The plates were fabricated from vacuum cast Al-9.5 wt % U, 93% enriched alloy. A flow sheet which shows the fabrication procedure is included. Development of Ceramic Fuel and High Absorbing Materials. Progress is reported in studies concerning the properties of PuC, PuC-UC systems, fueled glasses, and poison glasses. Other work is reported on investigations of UO_2, uranium oxide-lanthanum oxide systems, uranium oxide-neodymium oxide systems, urania-thoria systems, and U-thorium sulfide systems. Irradiation Evaluation of Various Experimental Fuel, Control, and Structural Materials. Effort was devoted to irradiations of ThO_2-UO_2 pellets, irradiations of ZrO_2-UO_2-CaO pellets, irradiations of UO_2 pellets with collapsed Al alloy cladding, irradiation of PuC and PuC–UC systems, post-irradiation annealing of Al-17.5 wt % U alloy, and Al-39 wt % U_3O_8 dispersion, irradiation of high-temperature fuel alloys, and irradiation of prototype SL-1 fuel plates. Other work is reported on the development of techniques for measurement of fission gas release from oxide fuels, development of metallographic techniques for fuels, and development of a pinhole-camera autoradiographic technique. Examination of Full-scale Reactor Fuel Elements and Control Rods. Activities include examination of EBR-I, MK III fuel rods, post-irradiation examination of Borax-III and -IV control rods, and measurement of water channel gaps in EBWR Core 1A fuel elements. Development of Corrosion-Resistant Jacketing and Structural Materials. Efforts were devoted to obtaining a high-temperature creep-resistant Al powder-product tubing, development of Ti-Zr alloys for use in superheated steam, evaluating corrosion of ferrous materials in water, corrosion of stainless steel in superheated steam, and investigation of Ti and Tl alloys for use with high-temperature Hg. Nondestructive Testing Development. Developmental investigations are reported on ultrasonic techniques, eddy current techniques, neutron techniques, x-ray radiography, and scintillation spectrometry. Miscellaneous Developments. Information is presented on operation and modification of the ANL-2 high-pressure water loop, Pu foil fabrication, and Zr tubing fabrication. Metallurgy of U and Its Alloys. Investigations are reported on the temperature dependence of elastic moduli in alpha U single crystals, crystallographic structure of alpha U as a function of temperature, Nb-U phase studies, UAlFe phase studies, and prediction of solid solubility in the lattice of alpha U. Metallurgy of Pu. Electrolytic methods were developed for the electrolytic preparation of high-purity Pu. Other work is reported on the effects of pressure on properties of delta-stabilized Pu alloys, alpha-beta transformations in Pu alloys, the electronic structure of delta Pu, and phase relations of the Pu-U-C system. Metallurgy of Zr. Studies are reported on textures in deformed single crystals of alpha Zr, the temperature dependence of elastic moduli in alpha-Zr single crystals and the plastic behavior of hydrided Zr. Alloying Properties. A search was initiated for intermetallic compounds which occur in binary metallic systems containing Tc^{99} as a common component with other transition elements. Data and information obtained in this program are presented. Other research is reported on occurrence and magnetic properties of C8 and sigma phases in V-Fe alloys. Initiation of a program to study the effects of a third component element on the super-conducting transition temperatures of Cr_3O-type binary compounds is reported. X-Ray and Neutron Diffraction Studies. Efforts were devoted to instrumentation for neutron diffraction investigations, studies of Ti_4Ni_2O and Ti_4Cu_2O crystal structures, studies of thermal neutron scattering amplitudes for Os isotopes, atomic and magnetic ordering in MnCo and development of a modified radial-distribution analysis for indexing x-ray powder patterns. Studies on Diffusion. Included are studies on self-diffusion in alpha U single crystals, diffusion in gamma U, and effects of magnetic order on diffusion. Nuclear Magnetic Resonance Research. Data obtained in NMR studies of Tc and Pu are presented. Corrosion Research. Investigations are reported on aqueous corrosion of 1100 Al, structures of Al-Ni and Al-Ni-Si films, mechanism of high-temperature Al corrosion, scale structure and effects in Zr corrosion, and the polarization behavior of 1100 Al. Irradiation Effects. A low-temperature irradiation facility to be located in hole VT 53 in the CP-5 reactor for fundamental studies of irradiation is under construction. Work was continued on fission fragment damage in Au films, as was an investigation on the swelling of U and U alloys by postirradiation annealing. Ceramics Materials Research. Investigations are reported concerning the mechanism of UO_2 sintering, H_2 and CO reduction of UO_2, radiation effects on MgO, and methods of UO_2 single crystal preparation. A field electron microscope was constructed for use in studies concerned with the properties of surfaces. (J.R.D.)

30718 (ANL-6548) STUDIES OF METAL–WATER REACTIONS AT HIGH TEMPERATURES. III. EXPERIMENTAL AND THEORETICAL STUDIES OF THE ZIRCONIUM–WATER REACTION. Louis Baker, Jr.,

and Louis C. Just (Argonne National Lab., Ill.). May 1962. Contract W-31-109-eng-38. 86p.

Further studies of the Zr-water reaction by the condenser-discharge method are reported. The reaction was studied with initial metal temperatures from 1100 to 4000°C with 30- and 60-mil wires in water from room temperature to 315°C (1500-psi vapor pressure). Runs in heated water showed markedly greater reactions. This was explained in terms of a 2-step reaction scheme in which the reaction rate is initially controlled by the rate of gaseous diffusion of water vapor toward the hot metal particles and of hydrogen, generated by reaction, away from the particles. At a later time, the reaction becomes controlled by the parabolic rate law, resulting in rapid cooling of the particles. A mathematical model of the reaction of molten metal spheres with water was proposed. Explosive reactions were found to occur with particles smaller than about 1 mm in heated water and 0.5 mm in room-temperature water. The explosive reactions were caused by the ability of the evolving H_2 to propel the particles through water at high speed. The high-speed motion was detected on motion picture film and had the effect of removing the gaseous diffusion barrier (increasing the Nusselt number), resulting in very rapid reaction. Computed results compared favorably with experimental results obtained by the condenser-discharge experiment and with the results of previous investigators. Computations indicated that the extent and rate of reaction depended on the particle diameter and the water temperature, and were relatively independent of the metal temperature so long as the metal was fully melted. This makes it possible to estimate the extent of Zr-water reaction that would occur during a reactor accident in which the particle sizes of the residue could be estimated. Comparisons were made with the results of meltdown experiments in TREAT, and applications to reactor hazards analysis were discussed. (auth)

30719 (ATL-A-130) INVESTIGATION OF THERMAL-STRESS-FATIGUE BEHAVIOR OF STAINLESS STEELS. Quarterly Technical Progress Report, January–March 1962. K. E. Horton (Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.). Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-250. 6p. (EURAEC-336)

Activities are reported concerning programs to obtain thermal stress-fatigue data on various types of stainless steels under conditions that may be encountered in reactor operation, and to separate the effects of various environmental and metallurgical variables. Work during the period was devoted to procurement and check-out of equipment, and to preliminary test work on specimens of type 304-L tubes and bar stock. (J.R.D.)

30720 (NP-12047) A TECHNIQUE FOR MELTING AND CASTING MAGNESIUM–LITHIUM ALLOYS. A. Saia and R. E. Edelman (Frankford Arsenal, Philadelphia and Frankford Arsenal. Pitman-Dunn Lab., Philadelphia). June 1962. 19p. (M62-26-1)

A simple technique for melting and casting magnesium-lithium alloys is described. After melting in an argon atmosphere without flux, the molten metal is poured into a mold made of steel, machined graphite, or rammed graphite. Two pouring methods may be used, depending upon the size and shape of the ingot or casting.

30721 (NP-12081) DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. Karen Barnes, comp. (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Aug. 1962. Contract AF 33(616)-7747. 53p.

References (126) on high-strength alloys, light metals, nonmetallics, and refractory metals are given to journals and reports published from November 1961 through July 1962. Author, subject, and DMIC numerical indexes are included. (P.C.H.)

30722 (NYO-10554) GROWTH OF METAL SINGLE CRYSTALS AND THE PRODUCTION OF HIGH PURITY METALS. Final Report. (Flow Corp., Cambridge, Mass.). July 1960. Contract AT(30-1)-2049. 42p.

Activities in a program to develop techniques for purifying metals and growing metal single crystals are reported. Information is included on crystal growth from melts, growth of solid solution alloy single crystals, interface location and control, preparation of high purity metals, and experimental results on zone refining. See also NSA Vol. 14, abst. 15910. (J.R.D.)

30723 (TID-16478) INTERMEDIATE-TEMPERATURE OXIDATION OF BERYLLIDES. Monthly Letter Report No. 10, June 1, 1962-July 1, 1962. Frank C. Perkins (Denver. Univ. Denver Research Inst.). July 8, 1962. Contract AT(11-1)-1092. 14p.

Continued study of the oxidation kinetics and characteristics of $ZrBe_{13}$, $ZrBe_{17}$, $NbBe_{12}$ and Nb_2Be_{17} at 1200 to 1800°F is reported. Observations of specimen conditions after exposure in water-saturated Ar at 1200, 1400, and 1600°F are included for $ZrBe_{13}$ and Zr_2Be_{17} along with oxidation curves for these tests. Comment concerning the metallography of the samples is included. (J.R.D.)

30724 (TID-16479) INTERMEDIATE-TEMPERATURE OXIDATION OF BERYLLIDES. Monthly Letter Report No. 11, July 1, 1962–August 1, 1962. Frank C. Perkins (Denver. Univ. Denver Research Inst.). Aug. 9, 1962. Contract AT(11-1)-1092. 9p.

Activities in an investigation of the oxidation kinetics and characteristics of $ZrBe_{13}$, Zr_2Be_{17}, $NbBe_{12}$, and Nb_2Be_{17} at 1200 to 1800°F are reported. Results of thermogravimetric experiments with $NbBe_{12}$ and Nb_2Be_{17} in water-saturated Ar are described. The oxidation observed in these experiments was minor, and it was found that Nb_2Be_{17} specimens did not crack during cooling. Oxidation characteristics of Nb_2Be_{17} are discussed. Experimental evidence indicates that a close connection does not exist between precipitate formation and disintegration in these beryllides, and observations suggest that intergranular precipitation is not responsible for disintegration at oxidation temperatures. It is believed that the disintegration phenomena can be explained on the basis of the stresses induced by oxide formation. (J.R.D.)

30725 (AEC-tr-4513) TRANSACTIONS OF THE INSTITUTE OF THE PHYSICS OF METALS, ISSUE 20, 1958. Translation of Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial, No. 20, 1-404(1958). 479p.

Twenty-six papers are presented. Topics covered include: quantum theory of solids, statistical theory of binding forces in oxides of transition metals with cubic lattice, quantum theory of optical theory of properties of magneto-elastic medium, problems in quantum-mechanical and phenomenological theory of ferro- and ferrimagnetism, anomalies of electric conductivity in antiferromagnets near the Neel point, phenomenological theory of ferromagnetic phenomena, magnetic structure of high-coercive-force ferromagnets, magnetic structure of crystals of silicon iron in state of remanent magnetization, connection between magnetic properties and sensitivity of magneto-striction receivers, methods of control of magnetic properties of electrotechnical sheet steel, comparative tests of

ferro-probes with longitudinal and transverse excitation, magnetic control of the structure and of mechanical properties of steel products, application of x-ray spectroscopy to investigation of the energy spectrum of electrons and interatomic binding forces in solids, method of absorption of x rays in the solution of problems in solid state physics, internal adsorption in solid solutions, manifestation of physical mechanism of reaction diffusion in the structural picture of layers of the reaction products, investigation of the laws of plastic deformation and breakdown, microscopic investigation of the mechanism of plastic deformation of metals and alloys, effect of high pressure on physical properties of solids, decomposition in metallic supersaturated solid solutions, structural mechanism of phase recrystallization during heating of steel, influence of prior heat treatment of steel on the kinetics of transformations of supercooled austenite, improvement in the structure and fracture of cast alloyed steel by heat treatment, strengthening of metastable austenitic alloys by phase cold hardening, and production of high heating rates for the investigation of electric heat treatment and for other purposes. A bibliography of 1088 works of the staff members of the Institute of the Physics of Metals, Ural Branch, Academy of Sciences USSR for 1932 to 1956 is included. (M.C.G.)

30726 HOW MATERIALS BEHAVE IN SPACE. L. D. Jaffe and J. B. Rittenhouse (California Inst. of Tech., Pasadena). Materials in Design Eng., 56: No. 3, 97-104(Sept. 1962).

An up-to-date report on the effects of vacuum, ions and electrons, electromagnetic radiation, and meteoroids on materials such as metals, semiconductors, polymers, oils and greases, and ceramics is presented. (P.C.H.)

30727 THE NEW WORLD OF CARBON AND GRAPHITE. Malcolm W. Riley. Materials in Design Eng., 56: No. 3, 113-28(Sept. 1962).

The emergence of carbon and graphite as engineering materials from their long-time status as components and the discovery of a variety of new forms in which the material can be produced are discussed according to their engineering performance and design. The main features, typical uses, and typical properties of the various types of carbons and graphites are given along with structural, thermal, electrical, and chemical nuclear properties, and the design and fabrication. (P.C.H.)

30728 THE EFFECTS OF LANTHANUM AND CERIUM IN THE REFINING OF IRON. STUDY OF THE REACTIONS WITH OXYGEN, SULPHUR AND CARBON IN SOLUTION. Jacques Richerd. Mém. sci. rev. mét., 59: 527-31(July-Aug. 1962). (In French)

The mechanism of the effect of the rare earths in steels is not adequately known. In former work, the required results could be influenced by too many factors. In order to eliminate most variables, pure iron was chosen as reaction medium, and the reaction components studied were added to it in known quantities. The first paper of this work deals with the choice of apparatus and products used, and also with the analytical methods. In particular, the two rare earths are detected and determined in very small quantities by a new method based on gamma spectrography. The iron-rare earth interactions are studied; the iron–lanthanum diagram has been determined. The absence of compounds of iron with lanthanum shows that the behavior of this rare earth must differ from that of cerium. (auth)

30729 THE METALLOGRAPHIC RADIOACTIVATION METHOD FOR INVESTIGATING THE SEGREGATION OF COPPER IN Al–Cu ALLOYS IN THE DEPENDENCE OF THE HEAT TREATMENT. M. Radman and J. Zmija. 1p. of "Pierwsze Krajowe Sympozjum Zastosowali Izotopów w Technice." Warsaw, Ośrodek Informacji, 1961.

Activation analysis was used, and Al–Cu samples containing up to 5% Cu were heat-treated under various conditions. The samples were activated in the reactor in a neutron flux of 10^{13} n/cm^2/sec for 7 hr. Samples in the form of small rods were fractured and the surface of the fragile fracture was dissolved in acid. The activities of the solutions were measured, and a comparison of the activities of the solutions with the activities of the corresponding standards showed the distribution of Cu. (OID)

30730 PROCESS FOR PREPARING GRANULAR THORIUM DIOXIDE OF DEFINITE PARTICLE SIZE AND SPHERICAL SHAPE. (to Stichting Reactor Centrum Nederland). British Patent 904,679. Aug. 29, 1962.

A process is given for producing thorium dioxide grains of uniform particle size and smooth, spherical surface. The process comprises dispersing a hydrosol of thorium oxide in a water-immiscible inert liquid, forming a gel by mixing the dispersion with a solution of ammonia or hexamethylenetetramine in the water-immiscible liquid, and calcining the gel. The liquid may be toluene or carbon tetrachloride, and the prolonged aging process heretofore used to treat the gel granules may be omitted. (D.L.C.)

30731 IMPROVEMENTS IN OR RELATING TO AUSTENITIC STAINLESS STEELS. Douglas White, John Frederick George Conde, and Peter Charles Leslie Pfeil (to United Kingdom Atomic Energy Authority). British Patent 905,238. Sept. 5, 1962.

Austenitic stainless steel alloys with optimum properties for use in fuel element sheaths in gas-cooled reactors comprise 0 to 0.07% C, 0.5 to 1.0% Mn, 0.25 to 0.75% Si, 24 to 26% Ni, 19 to 21% Cr, optionally up to 0.75% Nb or 0.5% Ti, and balance Fe. The maximum C is 0.03% when neither Nb nor Ti is present. Mechanical property and corrosion tests of these alloys in CO_2 and CO are described. (D.L.C.)

30732 GLASS COMPOSITION AND PROCESS OF MAKING. Adli M. Bishay (to U. S. Atomic Energy Commission). U. S. Patent 3,052,637. Sept. 4, 1962.

Glass compositions are described which are suitable for scintillators of thermal-neutron counters. The glass consists of from 70 to 75 mole % of B_2O_3, from 7 to 9 mole % of Ce_2O_3, and from 23 to 16 mole % of Al_2O_3 plus Na_2O in a mole ratio of 1 to 1.5. The process of making the glass from cerous oxalate, ammonium pentaborate, sodium carbonate, and hydrated alumina in a nonoxidizing atmosphere at 1400–1500°C is given. (AEC)

Corrosion

30733 (ARF-2181-12) THE MECHANISM OF STRESS CORROSION IN STAINLESS STEELS. Final Report, May May 15, 1959 to May 15, 1960. (Illinois Inst. of Tech., Chicago. Armour Research Foundation). For Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh. Contract [AT(11-1)-Gen-14], Subcontract 73-00-920. 78p.

The stress corrosion of austenitic stainless steel in a large number of aqueous and nonaqueous media were studied, with the conclusion that no specific ion, compound or solvent is essential to the cracking process. Evidence gathered from potential-time curves, acoustic observations and loading rate studies support the theory that the crack propagation mechanism is electrochemical in nature. Furthermore, direct examination of the surface of a

stress-corroding specimen by the electrochemical mapping technique revealed that anodic zones coincide with crack sites. It was concluded that investigation of the precracking perios of exposure is the most promising area for further study. (auth)

30734 (GEAP-3779) CORROSION OF TYPE 304 STAINLESS STEEL IN SIMULATED SUPERHEAT REACTOR ENVIRONMENTS. G. G. Gaul and W. L. Pearl (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Oct. 16, 1961. Contract AT(04-3)-189. 39p.

Type 304 stainless steel cladding material was corrosion tested under heat transfer conditions at metal temperatures up to 1300°F in specially constructed out-of-pile superheat facilities. The hydrogen and oxygen contents of the steam were controlled to simulate that found in boiling water reactor type systems. Good corrosion resistance and low metal release to system up to metal temperatures of 1100°F were experienced with an expected pattern of an initially high corrosion rate that decreased to a lower constant rate with time up to 4500 hours. A high-alloy layer developed adjacent to the scale in the 1100 to 1300°F metal temperature range on the heat transfer specimens. The layer continued to grow with time but had little effect on the corrosion rate within the 2500-hours of testing. Deposited carry-over products were analyzed. Intergranular attack was associated with scale fluxing in the higher temperature areas. (auth)

30735 (HW-73378) A COMPARISON OF THE CORROSION OF 304-L STAINLESS STEEL AND A-55 TITANIUM IN THE PUREX WASTE ACID SYSTEM. William L. Walker (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 28, 1961. Contract AT(45-1)-1350. 13p.

A portion of data developed pertaining to the corrosion of 304-L stainless steel and A-55 titanium in the Purex waste acid system is presented in graphic form. However, the data should be considered as a comparison of the corrosion of 304-L stainless steel and A-55 titanium in laboratory investigations, and should not be used for estimation of expected service life. (P.C.H.)

30736 (HW-SA-2333) EFFECT OF CYCLIC DECONTAMINATION ON CORROSION RATES. Lyle D. Perrigo (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 25, 1962. Contract AT(45-1)-1350. 19p.

Procedures simulating the cyclic filming and defilming in the decontamination of pressurized water-cooled reactors are evaluated using special equipment. A discussion is presented in which such equipment is described along with some latent corrosion effects discovered in these tests. (J.R.D.)

30737 (NMI-1903) BERYLLIUM CORROSION. Quarterly Report to United States Atomic Energy Commission for the Period, April 25, 1962 to July 25, 1962. J. P. Pemsler, D. S. Kneppel, and R. G. Jenkins (Nuclear Metals, Inc., Concord, Mass.). Aug. 31, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3012. 29p.

Investigations were made on factors influencing the corrosion of beryllium in high temperature water and steam. It was found that surface preparation appeared to have a significant effect on the corrosion behavior of beryllium. Etching of beryllium samples fabricated directly from powder resulted in increased attack. Cut samples showed a damaged surface layer which, unless removed by polishing, resulted in increased corrosion attack. It is judged that removal of 12 to 14 mils should be adequate. The results indicate that only materials fabricated directly from powder show significant corrosion resistance. Increasing the purity of beryllium resulted in decreased corrosion resistance. Coarse grained distilled and single crystal zone refined specimens underwent rapid catastrophic corrosion in water at 650°F. An apparatus was constructed to produce dilute alloys from high purity beryllium. Samples are melted in a BeO crucible, bottom poured and cast into a BeO mold. Three castings have been produced. (P.C.H.)

30738 THE CORROSION OF PRESSURE CIRCUIT MATERIALS IN BOILING AND PRESSURIZED-WATER REACTORS. F. L. Laque and M. A. Cordovi. Ing. Nucleare, 4: 142-54(July-Aug. 1962). (In Italian)

The pressurized boiling and non-boiling light-water reactor concepts are represented in most of the nuclear power stations built, under construction, or planned in the USA. Potential corrosion and erosion problems can be alleviated effectively by proper selection of materials for critical areas in such plants. The short operating time accumulated in such reactors does not afford a basis for assessment of the full extent to which deposition of activated corrosion products throughout the pressure circuit systems might complicate plant maintenance. Decontamination procedures are developed that give assurance that disposal of any activated crud can be accomplished in a practical manner. (auth)

30739 ALUMINUM ALLOYS WITH IMPROVED HIGH TEMPERATURE AQUEOUS CORROSION RESISTANCE. J. E. Draley, W. E. Ruther, and S. Greenberg (Argonne National Lab., Ill.). J. Nuclear Materials, 6: 157-71 (July 1962). (ANL-F6F-298). (In English)

The corrosion resistance of Al-1 wt % Ni-0.5 wt % Fe-0.1 wt % Ti (A288) was studied at 260 to 350°C. The temperature at which improved corrosion behavior was obtained depended on the silicon content, ranging from 315°C for 10 ppm Si to 360°C for 150 ppm Si. Static corrosion tests of A288 at 260, 290, and 350°C indicated no breakaway phenomenon during about 200 days exposure to water. Under dynamic conditions (315°C, 18 ft/sec, low ratio of Al surface to system volume) the alloy exhibited a constant corrosion rate of 4.2 mil per year. The application of stress during corrosion did not increase the intergranular penetration. No unusual or accelerated corrosion was found for A288 in a boiling test with a heat flux of 42 watts/cm^2 at 252°C, 600 psi. Significant increases in high temperature tensile strength were obtained by adding small amounts of zirconium and chromium to the basic composition. The creep resistance of the best alloy at 4000 psi-290°C was poor. Experiments designed to probe the mechanism of corrosion indicated that the corrosion barrier for low silicon alloys at 350°C was concentrated at or near the metal-oxide interface and that the deleterious effect of silicon was shared by other members of its periodic group. Chemical analyses showed that for low-silicon alloys at 350°C, the inner layer of corrosion product was enriched in iron and nickel, whereas the loose outer layer was depleted in these elements. At 290°C, the iron and nickel in the product were equal to the concentrations calculated from the composition of the alloy. For alloys containing more silicon, the corrosion product formed at 350°C was enriched in silicon. (auth)

Fabrication

30740 (ANL-6274) FABRICATION OF EBR-II, CORE-I FUEL PINS. H. F. Jelinek, N. J. Carson, Jr., and A. B. Shuck (Argonne National Lab., Ill.). June 1962. Contract W-31-109-eng-38. 29p.

A total of 11,117 enriched uranium-5 wt. % fissium alloy fuel pins was manufactured for EBR-II, Core I. These were made from a synthetic fission product alloy of nonradioactive elements, natural uranium, and enriched uranium. The material was supplied as precast billets. The manufacturing methods were developed for the EBR-II Fuel Cycle Facility. Experimental refabrication equipment was used to production test both the methods and the equipment. The billets were induction melted and pressure cast into precision-bore, high-silica glass molds in batches of 90 to 160. The number of molds used was adjusted according to batch weight. After casting, the molds were broken away and the castings were fed into a pin-process and inspection machine. Both ends were sheared from the castings to produce finished pins measuring 0.144 in. in diameter by 14.22 in. long. The pins were inspected for diameter, porosity, weight, and length. Rejected pins and sheared ends were broken into short lengths and returned for consolidation. Acceptable fuel pins were sealed and sodium bonded in stainless steel jackets, and assembled into Core-I fuel elements. (auth)

30741 (ASD-TDR-62-292) INVESTIGATION OF WELDING OF COMMERCIAL COLUMBIUM ALLOYS. J. M. Gerken and J. M. Faulkner (TAPCO. Div. of Thompson Ramo Wooldridge Inc., Cleveland). Mar. 1962. Contract AF 33(616)-7796. 145p.

An investigation was made of the welding characteristics of niobium base alloys; FS82, D31, and F48. Tungsten inert gas, electron beam, spot, and flash butt welding methods were investigated. The effect of the welding variables travel speed, shielding gas composition and purity, filler metal additions, preheat, and post heat were studied. Thermal cycles were measured in the fusion zone and heat affected zone of TIG welds to help explain mechanical properties and microstructure of each alloy. The effect of welding on all alloys was to increase the ductile to brittle transition temperature. This temperature was increased 200°F for FS82, 800°F for D31, and 500 to 800°F for F48 over that of the as-received wrought sheet. Of several post heat treatments investigated those most beneficial in lowering the transition temperature of welds were; 2000°F for 4 hours for FS82, 2100°F for 24 hours for D31, and 2500°F for 4 hours for F48. The electron beam welding process consistently produced more ductile welds than the TIG process. (auth)

30742 (ASD-TR-7-532a(VII)) MACHINING OF REFRACTORY MATERIALS. Phase II Technical Engineering Report, May 1, 1962–July 31, 1962. N. Zlatin, M. Field, and J. Gould (Metcut Research Associates Inc., Cincinnati). Aug. 7, 1962. Contract AF 33(600)-42349. 136p.

Machining studies were performed on pressed and sintered, forged and resintered, and arc cast unalloyed tungsten; D-31 niobium, 90Ta-10W alloy; silica reinforced phenolic resin; solid zirconium oxide; and zirconium and aluminum oxide coatings. The investigation consisted of face milling, end milling, drilling and tapping studies on tungsten and D-31 niobium; turning, face milling, drilling and tapping on silica reinforced phenolic resin; grinding of solid and flame sprayed zirconium and aluminum oxide coatings; and turning, face milling, end milling, drilling, reaming, tapping, and grinding on the 90Ta-10W alloy. (auth)

30743 (CEND-119) VIBRATORY COMPACTION OF DOUBLE ANNULAR FUEL ELEMENTS FOR NUSU CRITICAL EXPERIMENT. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Feb. 1961. Contract AT(11-1)-795. 29p.

A description of the processes used in fabrication of the fuel elements for this experiment is given. It is noted that no unusual problems arose during the loading phase and the run was considered successful. (J.R.D.)

30744 (CVNA-44) BONDING OF ZIRCALOY, NICKEL-IRON ALLOYS, AND STAINLESS STEEL. R. K. McGeary (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Feb. 1960. For Carolinas-Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract [AT(30-1)-2289]. 25p.

An experimental program was initiated to develop methods for metallurgically bonding nickel–iron alloys to both stainless steel and Zircaloy. Bonding studies on small pellet specimens comprise the main work completed and reported. Some experiments were completed with eutectic bonding (liquid phase formed at interface) and with brazing under a compressive load with Zr–4 Be alloy. In both of the types of bonds, brittle bond line fracture occurred in bend tests of the samples. Diffusion bonding of Ni–Fe alloy to stainless steel produced excellent joints as judged by bend tests and metallographic examination. The bond layers formed between Zircaloy and Ni–Fe alloy, however, were brittle. (auth)

30745 (DP-586) EXTRUSION OF URANIUM TUBES. R. E. Fisher (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). July 1961. Contract AT (07-2)-1. 38p.

Several hundred long, thin-walled uranium tubes were extruded to close dimensional tolerances by a potentially low cost fabrication process in commercial facilities. The principal process steps were: forging uranium ingots, machining the forged ingots into billets, and extruding the billets into tubes. Some 750 tubes (maximum dimensions: 3.5 inches in diameter and 15 feet long) were fabricated by this process. Dimensional control was excellent in that 88% of the tubes were within ±0.010 inch of average dimensions over their entire length. (auth)

30746 (DP-681) FABRICATION OF UO_2 FUEL ELEMENTS BY VIBRATIONAL COMPACTION. Harold G. Marsh (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Feb. 1962. Contract AT(07-2)-1. 16p.

Arc-fused UO_2 was vibrationally compacted to as high as 93.4% of theoretical density inside a stainless steel sheath tube. Selected particle sizes were used, and the assembly was vibrated axially in the frequency range of 300 to 1500 cps. The same blend of UO_2 particle sizes was vibrationally compacted to 87.5% of theoretical density within the annulus between two concentric stainless steel sheath tubes. The effects of particle size distribution, vibrational compaction procedure, sheath thickness, and fuel element shape on the maximum obtainable density were investigated. (auth)

30747 (EURAEC-280) SONIC AND ULTRASONIC COMPACTION OF UO_2. J. Servais and Cl. Descamps (Brussels. Centre d'Étude de l'Énergie Nucléaire and Société Belge pour l'Industrie Nucléaire, Brussels). Nov. 30, 1961. Work Performed under United States–Euratom Joint Research and Development Program. Contract 027-60-7RDB. 17p. (BN-6111-05)

Two methods for packing nonsintered ceramic fuels by applied vibration are described. Vibrationally compacted UO_2 is produced with frequencies in the sonic range and yield densities of 89 to 94% of the theoretical density depending on the diameter of the cladding material. Characteristics of the powder and cladding, frequencies and accelerations, particle size distribution, and floating restraint

are summarized. The response of the tube and the powder at different resonance frequencies is defined. (auth)

30748 (EURAEC-281) UO_2 COMPACTION BY SWAGING. H. Bairiot (Brussels. Centre d'Étude de l'Énergie Nucléaire and Société Belge pour l'Industrie Nucléaire, Brussels). Nov. 30, 1961. Work Performed under United States–Euratom Joint Research and Development Program. Contract 027-60-7RDB. 44p. (BN-6112-03)

The different parameters influencing cold and hot swaging behavior, such as the nature of the UO_2, cladding material (nature, diameter, and thickness), number of passes between annealing, and annealing temperature, are given. The influence of tube dimensions depends only on the diameter/thickness ratio. Good results can be obtained starting with a ratio up to 50. Cold swaging processes for the fabrication of a good quality fuel element with a density of 93 to 94% are described. Intermediate annealing at 950 to 1000°C might be necessary. The yield reaches 90% if the over-all density range is fixed at ±0.2 g/cm^3; the density is required to be uniform within ± 0.2 g/cm^3 along the rod; and the uniformity of the thickness along the rod is fixed ±4%. Densities of 96% and more can be obtained by hot swaging, but the quality of the tube is more difficult to control. (P.C.H.)

30749 (HW-SA-2112) NUCLEAR WELDING AT HANFORD. Thomas B. Correy (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 24, 1961. Contract [AT(45-1)-1350]. 24p.

Information concerning welding processes used at Hanford is presented. Details concerning representative examples are included on fabrication of Al clad AlSi process fuels, U ceramic fuels, Pu fuels, pressure vessels, and reactor equipment. Photographs of processes and products are included. (J.R.D.)

30750 (LADC-5281) PLUTONIUM FOUNDRY PRACTICES AT LOS ALAMOS SCIENTIFIC LABORATORY. J. W. Anderson and W. J. Maraman (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-36]. 57p.

The equipment, materials, and procedures used at the Los Alamos Scientific Laboratory to cast plutonium metal are described. The metal is melted in crucibles such as tantalum, magnesia, and other ceramics and poured into molds made of copper, tantalum, ceramics or coated steel or graphite. The mold coating is calcium fluoride. Castings are made in vacuum equipment. Crucibles and molds are heated by high frequency units. (auth)

30751 (ORO-541) CHARACTERIZATION OF UO_2 POWDERS. Monthly Progress Report, December 1961-January 1962. [James F. Carpenter] (United Nuclear Corp. Chemicals Div., Hematite, Mo.). Feb. 28, 1962. Contract AT(40-1)-2699. 9p.

A series of UO_2 powders were pressed without binder. The sintered density of pellets obtained by this method of pellet preparation showed a definite relation to powder particle size. Improved sinterability by physical and chemical comminution is discussed. (M.C.G.)

30752 (ORO-548) CHARACTERIZATION OF UO_2 POWDERS. Monthly Progress Report, February 1962. [James F. Carpenter] (United Nuclear Corp. Chemicals Div., Hematite, Mo.). Contract AT(40-1)-2699. 5p.

The effects of surface area and O/U ratio on the sinterability of UO_2 powders were studied. A series of 8 powders having a narrow range of sinterability were selected for further study. (M.C.G.)

30753 (ORO-567) CHARACTERIZATION OF UO_2 POWDERS. Monthly Progress Report, March 1962. [James F. Carpenter] (United Nuclear Corp. Chemicals Div., Hematite, Mo.). Contract AT(40-1)-2699. 9p.

The ceramic performances of a number of UO_2 powders were compared with their surface areas and O/U ratios. (M.C.G.)

30754 (ORO-568) CHARACTERIZATION OF UO_2 POWDERS. Monthly Progress Report, April 1962. [James F. Carpenter] (United Nuclear Corp. Chemicals Div., Hematite, Mo.). Contract AT(40-1)-2699. 6p.

The characterization of UO_2 powders by physical and chemical means and investigations of the relations between these variables and the ceramic activity of the powder were continued. Surface area correlation with low-temperature sintering of UO_2, particle size correlation with high-temperature sintering of UO_2, effects of O/U ratio on the sintering behavior of UO_2 in cracked ammonia atmosphere, and testing of industry samples are discussed. (M.C.G.)

30755 (UNC-3006) LOW TEMPERATURE SINTERING OF URANIUM DIOXIDE. Final Report on Process Development, April 15, 1959–December 31, 1961. N. Fuhrman, L. D. Hower, Jr., and R. B. Holden (United Nuclear Corp. Fuels Div., New Haven). Mar. 1, 1962. Contract AT(30-1)-2374. 84p.

A process for the fabrication of uranium oxide fuel pellets by an inert atmosphere low temperature sintering method was developed. Studies were conducted in view of the prospect of replacing conventional hydrogen sintering in the 1600 to 1700°C range with potentially less costly nitrogen sintering in the 1200 to 1300°C range. The low temperature process consists basically of a pretreatment of commercial ceramic grade (ADU) oxide to introduce excess oxygen, followed by granulation, pressing, and sintering. The presence of excess oxygen is essential to the process. An alternate sintering method was developed consisting of an initial sintering in hydrogen-free nitrogen followed by a short exposure to hydrogen, both operations being carried out at temperatures in the neighborhood of 1200°C. A number of methods to improve sinterability were explored and, of these, activation by oxidation-reduction cycling was by far the most effective. The introduction of fluorine in the range of 2000 to 2500 ppm seriously inhibited sintering. An estimated cost analysis is also presented. (P.C.H.)

30756 (EURAEC-321) STEAM SINTERING OF URANIUM DIOXIDE. Quarterly Progress Report No. 6, January 1, 1962 to March 31, 1962. (FIAT. Sezione Energia Nucleare, Turin). Apr. 30, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 011-60-9-RDI. 76p. A translation of FN-E-23.

Steam sintering experiments were conducted on 3 different UO_2 powders. Evolution of grain growth and the variation of pore number during densification were followed through micrographic analysis; evidence of discontinuous grain growth at relatively low temperatures was found only for one of the powders. The energy of activation for steam sintering was measured for the three powders: results were found to depend on the powder, but still were in the range of the values found in the literature, except that for comparatively low densities the energy is much larger. It was proved that the density of the inner part of a sintered pellet is lower than that of the outer part for hydrogen sintering, but not for steam sintering. Sintering of UO_2/U_3O_8 mixtures in inert gas was found to closely resemble steam sintering, except that in order to achieve high densities it was necessary to reduce to a minimum the amount of binder added to the powder. Considerable x-ray work was done to

check what happens to UO_2/U_3O_8 mixtures prior to sintering. (auth)

30757 FABRICATION OF CONCRETE BLOCKS FOR SHIELDING NUCLEAR REACTOR AND ACCELERATOR BUILDINGS. L. N. Zaitzev. Beton i Zhelezobeton, No. 5, 227-30(May 1962). (In Russian)

The design, construction, and specifications of prefabricated concrete blocks of various sizes and weights for reactor and accelerator shielding are discussed. Evaluations were made of various types of shielding and satisfactory results are reported. (R.V.J.)

30758 EXTRUSION OF METALS FOR NUCLEAR REACTOR APPLICATION. J. P. Pardoe. Metal Ind. (London), 100: 426-9(June 1, 1962).

The requirements for fuel element canning materials are outlined, and examples of fuel-canning material combinations are given. The extrusion characteristics of zirconium, beryllium, and uranium are discussed in some detail. (D.L.C.)

30759 VIBRATION-COMPACTED CERAMIC FUELS. Joseph J. Hauth (General Electric Co., Richland, Wash.). Nucleonics, 20: 50-4(Sept. 1962).

The advantages of the vibration-compaction method for making high-density ceramic fuels are outlined. Experiments conducted by Hanford on the method are described, and the use of the method for fabricating Plutonium Recycle Test Reactor fuel elements is discussed. The process variables affecting the compaction efficiency are discussed. The high-energy-forming process is being used to densify UO_2 powders prior to compaction. Various fuel and cladding materials used with the method are considered. Results of in-pile tests are described briefly. (D.L.C.)

30760 PREPARATION OF AND ELECTROPLATING ON URANIUM. Dwight E. Couch (National Bureau of Standards, Washington, D. C.). Plating, 49: 363-7(Apr. 1962).

The black film that forms between uranium and coatings electrodeposited on it results from the solutions used in aqueous cleaning and plating procedures. It was eliminated by using a completely anhydrous plating solution. A porosity test, using hydrogen, was developed for testing the porosity of plated coatings on uranium. (auth)

30761 CALCINATION OF ELECTROLYTIC NIOBIUM POWDER. V. M. Amosov. Tsvetnye Metally, 35: No. 2, 60-5(1962). (In Russian)

An analysis was made of technological processes in vacuum calcination of Nb powder with high admixture contents, average granule sizes of 60 to 8 μ, and loose weights of 2.05 to 2.10 g/cm^3. Calcination of 20 × 20 × 600 mm, 1.2 kg bars of ~88.0% Nb, 2.9% Ta, ~5% O_2, 3.35% C, 0.85% Fe, 0.35% Ni, 0.2% Ti, and 0.5% W produced plastic metal that was rolled into 0.1 mm thick strip. Before rolling the bar was cold forged and treated at 2300°C for 1 to 2 hours for final recrystallization and pore welding. The strip contained 99.3% (Nb + Ta), 0.03% C, 0.1% Ti, and 0.5% W. Ni and Fe were not found. (R.V.J.)

30762 IMPROVEMENTS IN OR RELATING TO FUEL FOR NUCLEAR REACTORS. Laurence Henry Cope (to United Kingdom Atomic Energy Authority). British Patent 904,366. Aug. 29, 1962.

A nuclear fuel for use at high temperatures is described. The fuel comprises an alloy or mixture of ≥20% fissile material with a ferritic creep-resistant steel. When the fissile material is non-metallic, the fuel may be prepared by mixing together the components in powdered form and compacting and sintering the mixture. A suitable steel is 2.25% Cr, 1% Mo ferritic steel known as ESSHETE CRM 2. (D.L.C.)

30763 IMPROVEMENTS IN OR RELATING TO GRAPHITE. (to Australian Atomic Energy Commission). British Patent 904,416. Aug. 29, 1962.

A process is given for reducing the permeability of a carbon or graphite body by a single impregnation treatment. The process comprises impregnating the body with a mixture of a monomer and a polymerization catalyst effective at elevated temperatures, dipping the body in a catalyst effective at ordinary temperatures to polymerize the monomer at the surface, and heating the body to polymerize the rest of the monomer. An example of the process is given in which the body was impregnated with furfuryl alcohol–benzal chloride, dipped in concentrated hydrochloric acid to polymerize the surface, washed, and heated to 120°C for 48 hr and then to 800°C. The permeability coefficient was reduced from 2.8×10^{-2} to 1.4×10^{-6} cm^2/sec in this way, as compared with a reduction to 4.5×10^{-4} cm^2/sec for the same treatment without the surface polymerization step. (D.L.C.)

30764 IMPROVEMENTS RELATING TO RADIATION BARRIERS. (to Becton, Dickinson and Co.). British Patent 904,774. Aug. 29, 1962.

A method is given for preparing a radiation barrier film which is flexible, has high tensile strength, and can be molded, dipped, sprayed, or otherwise fabricated into protective clothing and coatings. In the method, a suspension of a gelling agent, a liquid dispersant, finely divided resin particles, and finely divided particles of a radiation-shielding heavy metal is prepared which has thixotropic properties. The suspension is formed into the shape of a barrier article and then cured. The resin material preferably is polyvinyl chloride, while the liquid dispersant is one or more plasticizers mixed with monomers or prepolymers. Several examples of the method are given. (D.L.C.)

30765 MANUFACTURE OF LONGITUDINALLY FINNED TUBES OR RODS. Joseph Clifford Guest and William Arthur Sallis (to T. I. (Group Services) Ltd.). British Patent 905,068. Sept. 5, 1962.

A method is outlined for manufacturing longitudinally finned tubes or rods from metals which are difficult to work, e.g., beryllium, stainless steel, or zirconium. In this method, a longitudinally finned billet is formed and enclosed within an envelope having complementary fins on its internal periphery, and the combined billet and envelope are extruded or drawn and the envelope subsequently removed. Two examples of the method are given in which beryllium and stainless steel were used. (D.L.C.)

30766 IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF LEAD BRICKS. Sidney Ernest Van Den Broek (to Graviner Mfg. Co. Ltd.). British Patent 905,727. Sept. 12, 1962.

A method and an apparatus are described for the cold-forming of lead shielding bricks with male and female surfaces. The advantages of bricks made in this way are absence of air pockets (common in bricks made by casting) and smooth surface finish. (D.L.C.)

30767 METHOD FOR COATING GRAPHITE WITH NIOBIUM CARBIDE. (to U. S. Atomic Energy Commission). British Patent 906,064. Sept. 19, 1962.

A method is given for bonding niobium to a graphite surface to form a niobium carbide coating. The method comprises disposing finely divided niobium as a thin layer on the surface, the distance between the niobium particles not exceeding one inch, degassing the surface in a vacuum, and rapid heating to >2500°C to cause the niobium to melt and wet the surface. (D.L.C.)

30768 IMPROVEMENTS IN OR RELATING TO RESISTANCE WELDING. Edward John Keefe (to United Kingdom Atomic Energy Authority). British Patent 906,451. Sept. 19, 1962.

A method is given for the resistance welding together of magnesium alloy parts which are easily contaminated by copper electrodes. The method comprises interposing between each of the welding electrodes and the parts a thin (e.g., 0.003-in. thick) steel strip. The method is applicable to the attachment of Magnox fins to reactor fuel elements with Magnox sheaths. (D.L.C.)

30769 PROCESS FOR PRODUCING HIGH DENSITY REFRACTORY BODIES. Donald L. Schwartz (to General Electric Co.). U. S. Patent 3,051,566. Aug. 28, 1962.

A process for producing refractory bodies with a density approaching theoretical from powders is given which avoids the addition of densifying agents. The process comprises maintaining the ratio of the number of 0.1- to 0.5-μ particles to the number of 0.8- to 2.5-μ particles in the powder at a value ≥3.0, blending the powder with a lubricant-binder to form a free-flowing mixture of ≥23% theoretical density, forming a green solid body of ≥40% theoretical density, presintering the body to remove the lubricant-binder, and sintering the body at a high temperature to produce a body with 94 to 100% theoretical density. Flowsheets are given for UO_2. (D.L.C.)

30770 CASTING SLIPS FOR FABRICATION OF REFRACTORY METAL WARE. Stephen D. Stoddard, Donald E. Nuckolls, and Robert E. Cowan (to U. S. Atomic Energy Commission). U. S. Patent 3,052,532. Sept. 4, 1962.

A composition is given for slip casting tungsten metal. The composition consists essentially of tungsten metal with an average particle size of 0.9 micron, an organic vehicle such as methyl chloroform, o-xylene, n-butyl acetate, isobutyl acetate, and 1, 1, 2, 2-tetrachlorethane, and a suspending agent such as ethyl cellulose, with the approximate ratio of said vehicle to the tungsten metal being 12 cc of a solution containing from 5 to about 20 grams of said ethyl cellulose in 400 cc of said organic vehicle per 100 grams of metal. (AEC)

30771 PREPARATION OF ACTINIDE-ALUMINUM ALLOYS. Raymond H. Moore (to U. S. Atomic Energy Commission). U. S. Patent 3,052,536. Sept. 4, 1962.

A process is given for preparing alloys of aluminum with plutonium, uranium, and/or thorium by chlorinating actinide oxide dissolved in molten alkali metal chloride with hydrochloric acid, chlorine, and/or phosgene, adding aluminum metal, and passing air and/or water vapor through the mass. Actinide metal is formed and alloyed with the aluminum. After cooling to solidification, the alloy is separated from the salt. (AEC)

30772 PREPARATION OF URANIUM-ALUMINUM ALLOYS. Raymond H. Moore (to U. S. Atomic Energy Commission). U. S. Patent 3,052,537. Sept. 4, 1962.

A process is given for preparing uranium–aluminum alloys from a solution of uranium halide in an about equimolar molten alkali metal halide–aluminum halide mixture and excess aluminum. The uranium halide is reduced and the uranium is alloyed with the excess aluminum. The alloy and salt are separated from each other. (AEC)

30773 COMPARTMENTED REACTOR FUEL ELEMENT. F. M. Cain, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,053,743. Sept. 11, 1962.

A method of making a nuclear reactor fuel element of the elongated rod type is given wherein the fissionable fuel material is enclosed within a tubular metal cladding. The method comprises coating the metal cladding tube on its inside wall with a brazing alloy, inserting groups of cylindrical pellets of fissionable fuel material into the tube with spacing members between adjacent groups of pellets, sealing the ends of the tubes to leave a void space therewithin, heating the tube and its contents to an elevated temperature to melt the brazing alloy and to expand the pellets to their maximum dimensions under predetermined operating conditions thereby automatically positioning the spacing members along the tube, and finally cooling the tube to room temperature whereby the spacing disks become permanently fixed at their edges in the brazing alloy and define a hermetically sealed compartment for each group of fuel pellets. Upon cooling, the pellets contract thus leaving a space to accommodate thermal expansion of the pellets when in use in a reactor. The spacing members also provide lateral support for the tubular cladding to prevent collapse thereof when subjected to a reactor environment. (AEC)

30774 RADIATION SHIELDING MATERIALS. Lyle B. Borst (to Dow Chemical Co.). U. S. Patent 3,053,776. Sept. 11, 1962.

A shielding material is described which has a high shielding effectiveness per unit volume and a high capacity for absorbing radiations. The material comprises a chemical complex of trivalent cobalt or chromium, such as the perrhenates and hexamino trihalides, in combination with a structural material such as iron, stainless steel, etc. The complex may be melted and cast as a layer between sheets of lead, iron, etc., to form a sandwich, or it may be incorporated into a thermoset or thermoplastic resin. (D.L.C.)

30775 METHOD FOR SOLVENT-ISOSTATIC PRESSING. Paul B. Archibald (to U. S. Atomic Energy Commission). U. S. Patent 3,054,147. Sept. 18, 1962.

This invention provides a method for producing densely compacted bodies having relatively large dimensions. The method comprises the addition of a small quantity of a suitable solvent to a powder which is to be compacted. The solvent-moistened powder is placed inside a flexible bag, and the bag is suspended in an isostatic press. The solvent is squeezed out of the powder by the isostatic pressure, and the resulting compacted body is recovered. The presence of the solvent markedly decreases the proportion of void space in the powder, thereby resulting in a denser, more homogeneous compact. Another effect of the solvent is that it allows the isostatic pressing operation to be conducted at substantially lower pressures than are conventionally employed. (AEC)

30776 NEUTRON SHIELDING STRUCTURE. James T. Mattingly (to U. S. Atomic Energy Commission). U. S. Patent 3,056,028. Sept. 25, 1962.

A lightweight neutron shielding structure comprises a honeycomb core which is filled with a neutron absorbing powder. The honeycomb core is faced with parallel planar facing sheets to form a lightweight rigid unit. Suitable absorber powders are selected from among the following: B, B_4C, B_2O_3, CaB_6, Li_2CO_3, LiOH, $LiBO_2$, Li_2O. The facing sheets are constructed of a neutron moderating material, so that fast neutrons will be moderated while traversing the facing sheets, and ultimately be absorbed by the absorber powder in the honeycomb. Beryllium is a preferred moderator material for use in the facing sheets. The advantage of the structure is that it combines the rigidity and light weight of a honeycomb construction with the neutron absorption properties of boron and lithium. (AEC)

Properties and Structure

Refer also to abstract 30332.

30777 (ANL-6529) THORIA AND THORIA-URANIA REINFORCED BY METAL FIBERS. Y. Baskin and J. H. Handwerk (Argonne National Lab., Ill.). June 1962. Contract W-31-109-Eng-38. 29p.

Thoria compacts containing refractory metal fibers in quantities as low as 5 wt % showed significantly better resistance to thermal shock spalling than thoria alone. Of the metals and alloys evaluated, molybdenum and niobium gave the best results. Values are presented for room- and elevated-temperature properties of fiber-reinforced thoria. Measured properties included compressive strength, modulus of rupture, impact strength, thermal shock resistance, thermal conductivity, thermal expansion, and oxidation resistance. The widespread presence of microcracks in these compacts resulted in significantly lower strengths and elastic moduli than those of thoria. Fibers improve resistance to thermal spalling by suppressing and limiting crack propagation and by structurally reinforcing the cracked body. Room-temperature thermal conductivity of reinforced thoria is slightly higher than that of thoria, but at 1600°C it is 3 times greater. Oxidation resistance of molybdenum-reinforced thoria is best of all combinations investigated and improves with increased specimen density. However, because of the presence of microcracks, even the densest specimens are severely attacked after 24 hr in air at 1000°C. Thoria-urania compacts reinforced with molybdenum fibers were bonded together by means of conventional brazing techniques. Irradiation of metal-reinforced thoria-urania specimens indicated that molybdenum fibers aided the heat transfer from the fuel, whereas niobium fibers reacted with the fuel and lost their effectiveness. (auth)

30778 (AWRE-0-48/62) A METALLOGRAPHIC STUDY OF THE AGEING CHARACTERISTICS OF BERYLLIUM–IRON ALLOYS, BETWEEN 400°C AND 1050°C. Helen M. Lindsay and A. Moore (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Aug. 1962. 30p.

The aging characteristics of Be–Fe alloys containing 0.03 to 0.4 wt % Fe were determined by tensile testing at 600°C. Specimens from cast-and-extruded alloys were examined in the as extruded and aged conditions and also after cycling between the solution treated and aged conditions. There was agreement between the metallographic observations and the corresponding ranges for solution treatment and aging, as defined from mechanical properties. It was concluded, however, that in no case is a single phase solid solution retained on quenching to 20°C. Generally, aging at temperatures of 100 to 200°C below the solution treatment zone led to precipitation primarily on a network 5 to 10 μ wide, adjacent to the grain boundaries, and to a lesser degree within the matrix. By contrast, aging at higher temperatures led to an increase in precipitation at grain boundaries, and the development of a denuded zone 5 μ wide adjacent to the grain boundaries. (P.C.H.)

30779 (BMI-1277) PROPERTIES OF ARC-MELTED CHROMIUM-BASE ALLOYS. Daniel J. Maykuth, John W. Roberts, Jr., and Robert I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). July 14, 1958. Contract W-7405-eng-92. 27p.

Twelve binary chromium-base alloy systems were screened for hot workability, oxidation resistance, and hot strength using small arc-melted ingots. The alloying elements investigated included Fe, Mn, Mo, Nb, Re, Ru, Ta, Ti, W, V, Zr, and Y in amounts up to 20 wt %. Of the fabricable alloys tested, the best combinations of oxidation resistance and strength, in the range of 2000 to 2300°F, were found in binary alloys containing 5 wt % molybdenum, 10 wt % tungsten, and 2 wt % niobium. While yttrium additions do not contribute to the hot strength of chromium, the effectiveness of yttrium in improving the oxidation resistance of chromium is outstanding. About 1 wt % yttrium appears optimum for this purpose. Experiments with the preparation of large chromium-base alloy ingots showed that cold-mold arc melting was not suitable for preparing ingots containing over about 1 wt % of alloy addition. However, the feasibility of preparing sound, higher alloy-content ingots by induction melting and casting was demonstrated. (auth)

30780 (BMI-X-170(Del.)) PROPERTIES OF PuO_2 AND PuO_2–ThO_2 CERAMICS. Stan J. Paprocki, Donald L. Keller, Carl A. Alexander, and William M. Pardue (Battelle Memorial Inst., Columbus, Ohio). June 30, 1961. Decl. with deletions Jan. 15, 1962. Contract [W-7405-eng-92]. 38p.

Procedures for the preparation of sintered bodies of PuO_2 and solid solutions of PuO_2 with ThO_2 were developed. The PuO_2–ThO_2 ceramics contained from 30 to 70 wt % PuO_2. Volatility determinations of PuO_2 were performed in air, argon, and oxygen using a transpiration vapor pressure technique. PuO_2–ThO_2 solid solutions were formed by sintering for $3\frac{1}{2}$ hr at 1650 or 1725°C in argon. Sintering in hydrogen under the same conditions resulted in reduction of some PuO_2 to Pu_2O_3. PuO_2 is considered stable under oxidizing and neutral conditions. All indications are that PuO_2 vaporizes congruently and has a vapor pressure in air of approximately 10^{-7} atm at 2000°K (1730°C). The addition of ThO_2 is expected to increase the melting point of the mixture over that of pure PuO_2. (auth)

30781 (BNL-6263) MEASUREMENTS OF THE VIBRATIONAL FREQUENCY SPECTRUM OF NICKEL–PALLADIUM ALLOYS. Bernard Mozer and Kare Otnes (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 10p.

Cold neutron inelastic scattering experiments were conducted on 0, 5, 10, 20, and 100% polycrystalline nickel-palladium alloys at room temperature. The inelastic neutron scattering cross section was measured at several scattering angles. Results for the low nickel alloys indicate that one of the peaks in the inelastic neutron scattering data corresponds to a simple defect mode of vibration, confirming theoretical predictions. (auth)

30782 (CEND-122) THE DEVELOPMENT AND TESTING OF THE UO_2 FUEL ELEMENT SYSTEM. Quarterly Report, December 1, 1960–February 28, 1961. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Mar. 1961. Contract AT(30-1)-2379. 54p. (NYO-9011)

Vibratory compaction experiments continued to show good results in regard to powder densification and process feasibility. Compaction reproducibility was demonstrated on 48 samples. Stainless steel tubes filled with fused, depleted UO_2 vibratory compacted to densities of 85 to 88% theoretical were subjected to cross sectional reductions of 6 to 12% by cold swaging. Visual examinations after swaging revealed neither wrinkles, fins, nor cracks in the cladding. The use of straight wire spacers in progressive layer assembly resulted in better weld reproducibility.

Metallographic examination and tensile tests were completed on annealed stainless steel tubing. Design of some of the test equipment components was revised. (auth)

30783 (EURAEC-283) PHASE TRANSFORMATION IN ZIRCONIUM 10–25% NIOBIUM ALLOYS. D. Quataert (Brussels. Centre d'Étude de l'Énergie Nucléaire and Société Belge pour l'Industrie Nucléaire, Brussels). [1957]. Work Performed under United States–Euratom Joint Research and Development Program. Contract 027-60-7RDB. 47p. (BN-6203-11)

Zirconium-niobium alloys were studied to develop new matrixes for dispersed plutonium oxide and carbide fuels. Transformation reactions for zirconium base niobium alloys are described. The monotectoid temperature occurs at 597.5 ± 1.5°C and the maximum solubility of niobium in zirconium is 2%. Two transformation reactions can occur in alloys containing 10–25% niobium. Transformation in the temperature range 450–600°C results first in the precipitation of α zirconium and finally in the decomposition of the high-temperature β phase into the equilibrium forms of α zirconium and β niobium. Below 400°C, a metastable omega phase can occur. In the higher range of temperatures, an increase in niobium content in alloys of this range of compositions results in an increased incubation period and decreased reaction rates for the transformation. (auth)

30784 (GA-3376) A PROGRAM OF BASIC RESEARCH ON MECHANICAL PROPERTIES OF REACTOR MATERIALS. Quarterly Progress Report for the Period Ending June 30, 1962. T. A. Trozera, P. W. Flynn, R. H. Chambers, and J. L. White (General Atomic Div. General Dynamics Corp., San Diego, Calif.). July 25, 1962. Contract AT(04-3)-167. 22p.

The effect of modifying the dislocation structure by room-temperature prestraining on the subsequent yielding behavior at 77°K is being studied. Results on tantalum single crystals indicated that a considerable decrease in the early yield stress for a given strain is effected by prestraining at room temperature. Twinning was observed in the tantalum at 77°K and normal rates of strain. It is shown that the potential barrier to dislocation motion in crystalline solids can be measured in relatively pure bcc transition metals such as Nb, Ta, Mo, and W. Work is being carried out to extend the method of differential calorimetry to measurements of stored-energy-release spectra in deformed bcc metals. Measurements for copper are discussed. (M.C.G.)

30785 (HW-74024) LATTICE CONSTANTS AND PHASE RELATIONS OF ARC MELTED PLUTONIUM–CARBON ALLOYS. T. D. Chikalla (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1962. Contract AT(45-1)-1350. 24p.

The nonstoichiometric phase that occurs during arc melting of PuC was found to exist in the region extending from 39.8 to 49.1 at.% C. The associated lattice constants for carbon deficient and carbon rich PuC are 4.9583 and 4.9742 Å, respectively. Density measurements showed that the defect NaCl structure occurs with a carbon deficiency. Below 39.8 at.% C there is some indication of plutonium solubility in the nonequilibrium cast structure. Heat treatment caused the arc cast phase boundaries to decrease slightly and showed the existence of the zeta phase characterized by a very large number of weak and diffuse lines. An unusual change was detected in the lattice constant of the PuC phase with time at room temperature. (auth)

30786 (IS-247) TERNARY COMPOUNDS BETWEEN THORIUM MONOCARBIDE AND THORIUM DIHYDRIDE. D. T. Peterson and J. Rexer (Ames Lab., Ames, Iowa). [Jan. 5, 1961]. Contract [W-7405-eng-82]. 15p.

The thorium–hydrogen–carbon system was studied by measuring hydrogen equilibrium pressures at various compositions and temperatures. Two compounds, ThC · ThH_2 and ThC · $2ThH_2$, were found and characterized. ThC · ThH_2 has a hexagonal closest-packed lattice with $a_0 = 3.816$ and $c_0 = 6.302$Å. ThC · $2ThH_2$ had a monoclinic lattice with $a_0 = 6.50$, $b_0 = 3.80$, $c_0 = 10.91$Å and $\beta = 119°$. The enthalpies of formation for each compound were determined. (auth)

30787 (IS-257) STRUCTURES OF THE INTERMEDIATE PHASES $Ni_{10}Zr_7$ AND $Ni_{10}Hf_7$. M. E. Kirkpatrick, J. F. Smith, and W. L. Larsen (Ames Lab., Ames, Iowa). [Feb. 1, 1961]. Contract [W-7405-eng-82]. 24p.

The crystal structures of the intermediate phases $Ni_{10}Zr_7$ and $Ni_{10}Hf_7$ were determined from single crystal data. The phase $Ni_{10}Zr_7$ shows some solid solubility which produces a structural distortion with an attendant change in space group symmetry when the composition varies from that of stoichiometry. Lattice dimensions of $a_0 = 12.386$, $b_0 = 9.156$, and $c_0 = 9.211$ Å were determined for the stoichiometric phase which has the space group symmetry C_{2v}^{17}–C2cа. The structure is distorted to produce space group symmetry D_{2h}^{15}–Pbca when the composition of the phase becomes rich in zirconium with respect to stoichiometry. The room temperature lattice dimensions of the phase at maximum zirconium saturation were determined as $a_0 = 12.497$, $b_0 = 9.210$, and $c_0 = 9.325$ Å. The nature of the zirconium solubility in this phase was deduced from a knowledge of the interatomic distances between neighboring atoms as a random substitution of zirconium atoms on certain nickel sites. Sufficient data were obtained for the stoichiometric $Ni_{10}Hf_7$ phase to show it to be isostructural with the stoichiometric $Ni_{10}Zr_7$ phase. Lattice dimensions of $a_0 = 12.275$, $b_0 = 9.078$, and $c_0 = 9.126$ Å were determined for the stoichiometric $Ni_{10}Hf_7$ structure. (auth)

30788 (IS-268) POINT IMPERFECTIONS IN METALS: EXISTENCE AND DETECTION. J. F. Smith (Ames Lab., Ames, Iowa). [Feb. 23, 1961]. Contract [W-7405-eng-82]. 12p.

The nature and role of crystalline imperfections in metals are examined. A review of information concerning the crystalline nature of metals is included along with pastulations concerning point imperfections such as vacancies and interstitials. Microscopic observations which substantiate the existence of linear imperfections which are synonymous with dislocations are noted. An illustration is included to show the interrelation between vacancies, interstitials, and dislocations. Other discussions are included concerning the inverse relations of point defects and dislocations. Experiments to verify the existence of vacancies and interstitials in pure metal lattices and to obtain information on point imperfections are also discussed. (J.R.D.)

30789 (LAMS-2725) H4LM GRAPHITE. R. G. Merryman, P. Wagner, and D. P. MacMillan (Los Alamos Scientific Lab., N. Mex.). July 5, 1962. Contract W-7405-Eng-36. 89p.

A commercial graphite useful in nuclear reactor construction is described. A survey of all currently available sources on chemical and physical properties was made and the information listed. Some data on cost and available sizes are also included. (auth)

30790 (MITS-48) THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Semi-Annual Progress Report for the Six-

Month Period Ending April 30, 1962. (Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy). Contract AT(30-1)-956. 46p. (NYO-9203)

Research progress on flotation, surface chemistry, solvent extraction, communication, thickening and thickeners, and hysteresis of contact angles is reported. Topics covered include: mixed adsorption from gaseous phase on to ferric oxide, adsorption study of hematite–water–diisobutyl ketone, adsorption of inogranic ions on ferric oxide, dissolution of zinc sulfide in acid media, interaction between two bodies separated by fluid electrolyte, hysteresis of contact angles, the thickening mechanism, radioisotopes for coarse ore concentration, and measurement of particle size distribution in the submicron size. (M.C.G.)

30791 (MRC-182) GRAIN-BOUNDARY SLIDING IN NON-METALLIC BICRYSTALS. Final Report. M. A. Adams and G. T. Murray (Materials Research Corp., Yonkers, N. Y.). Aug. 31, 1960. Contract AT(30-1)-2178. 40p.

Lack of agreement between experimental investigations concerning the creep properties of non-metallic crystalline solids raises doubts as to whether high-temperature polycrystalline anelasticity effects can always be unequivocally related to grain-boundary sliding, and to doubts as to whether grain-boundary sliding actually occurs in non-metals. An investigation of grain-boundary sliding by studying directly the grain-boundary behavior in deformed bi-crystals of selected non-metals is described. Specimens studied included alumina, magnesia, and NaCl. It was found that NaCl and magnesia exhibit grain-boundary sliding effects. It is noted that the experiments were not extensive enough to test the general theory of grain-boundary sliding; however, the observations are in general agreement with those of other investigators. (J.R.D.)

30792 (NMI-TJ-40(Rev.)) IMPURITY EFFECTS IN COMMERCIALLY PURE BERYLLIUM PREPARED FROM POWDER. A. K. Wolff, S. H. Gelles, and L. R. Aronin (Nuclear Metals, Inc., Concord, Mass.). [1961]. Contracts AT(30-1)-1565 and AF33(616)-7065. 25p.

An investigation was conducted to determine the role of impurities in commercial beryllium prepared from powders. It was found that room temperature tensile properties of beryllium can be altered by aging treatments. Ultimate strengths were found to vary from 52000 to 95000 psi and ductilities varied from less than 1 to 14%. No significant changes in yield strength were observed. Subsequent studies showed that no textural changes occurred during aging, and the tensile property variations were attributed to precipitation phenomena. A yield point, absent in the as-solution-treated material, was observed to occur after aging at 400°C, but the occurrence of the yield point appeared to be sensitive to minor variations introduced in the processing, presumably variations in grain size. Limited high temperature tensile data showed that properties between room temperature and 400°C increased with decreasing cooling rate from the solutionizing temperature. Repeated yielding was observed for tests at 400 but not at 600°C. X-ray diffractometer studies showed the growth, after aging, of precipitate peaks which were not present in the as-solution-treated state. The precipitate was identified as a face-centered-cubic structure with a lattice constant of 6.07Å and having a preferred orientation with respect to the beryllium matrix. Electron microbeam probe studies indicated that iron segregated to the grain boundaries during aging. Aluminum and silicon were found to be segregated at grain boundaries even in the solution treated case. Strain-aging studies showed that a yield point induced by aging and eliminated by straining could be recovered by subsequent aging. An activation energy for return of the yield point was determined to be 48000 cal/g mole which compared favorably with the activation energies for diffusion of iron and nickel in beryllium. The observed strain-aging phenomena were consistent with the Cottrell theory of dislocation-locking by impurity atmospheres. (auth)

30793 (NP-11993) HEAT TREATMENT OF DILUTE ALLOY URANIUM RODS. W. J. S. Craigen (Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa). May 1961. 16p. (T61-24)

Samples of cast uranium rods containing small additions of iron, aluminum, and carbon were beta heated, quenched, and alpha annealed to determine the effect on grain size and structure. Minimum average grain size obtained was 60 micron. High alpha annealing failed to produce a recrystallized grain structure from the beta quenched samples. (auth)

30794 (NP-11998) RELATION OF EQUILIBRIUM PHASE TRANSITION PRESSURE TO IONIC RADII. Technical Report No. 15. Vladimir Stubican and Rustum Roy (Pennsylvania State Univ., University Park. Coll. of Mineral Industries). June 30, 1962. Contract Nonr-656(20). 19p.

P-t equilibria for a series of some 20 rare earth arsenates ($LnAsO_4$) and vanadates ($LnVO_4$) which undergo reconstructive transitions (xenotime ⇌ scheelite) in the region 10,000 to 60,000 atm were obtained. From these curves, a set of data was extracted representing (under a fair approximation to corresponding states) the change of equilibrium pressure for a transition as a function of the radius of the Ln^{3+} ion. The result is a V shaped curve in both the arsenates and the vanadates showing a minimum transformation pressure near Dy^{3+} or Ho^{3+}. An even-odd effect is also noted. (auth)

30795 (NP-12049) MECHANICAL PROPERTIES OF SILICON CARBIDE SINGLE CRYSTALS. Final Report, May 12, 1961–August 12, 1962. H. D. Batha and D. P. H. Hasselman (Carborundum Co. Research and Development Div., Niagara Falls, N. Y.). Sept. 1962. Contract NOw-61-0676-c. 37p.

Results are reported from an investigation of the mechanical properties of vapor phase grown single crystals of silicon carbide. Equipment was designed to deform the crystals in bending by three-point loading. Preliminary results for Young's modulus of elasticity and crossbending strength are reported. Values of strength as high as one million psi were obtained. A correlation was found between sample thickness and strength. The strength at 1750°C considerably exceeds the strength at room temperature. No evidence of gross plastic deformation under mechanical load was found as high as 1800°C. Some observations were made of dislocation motion during etching at 900°C in boron. (auth)

30796 (NUMEC-P-101) DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Progress Report, April 1 through June 30, 1962. (Nuclear Materials and Equipment Corp., Apollo, Penna.). Contract AT(30-1)-1389. 41p.

Progress in the development and testing of plutonium fuels is described. Topics covered include: project and facility administration, preparation and characterization of fuel materials, fabrication and evaluation of fuel shapes, fuel element fabrication and evaluation, radiation testing and evaluation, and reactor physics and engineering parametric studies. (M.C.G.)

30797 (ORNL-2972) EFFECT OF ENVIRONMENT ON THE CREEP PROPERTIES OF TYPE 304 STAINLESS STEEL AT ELEVATED TEMPERATURES. H. E. McCoy, Jr. and D. A. Douglas, Jr. (Oak Ridge National Lab., Tenn.). Sept. 18, 1962. Contract W-7405-eng-26. 57p.

The effects of Ar, H_2, CO, CO_2, N_2, air, and O_2 on the creep properties of type 304 stainless steel were studied. The results of completed tests indicate that air, CO, CO_2, and N_2 are strengthening to the alloy. Carburization and nitriding are believed to be primarily responsible for the strengthening in these environments. At 1500°F, O_2 at 1 atm pressure has a deleterious effect on the creep properties, but at 1700°F the creep properties are improved. Creep tests at 1500°F in various argon–oxygen mixtures show that small oxygen concentrations cause pronounced strengthening with a maximum effect being observed at 10 ppm O_2. At 1500°F the creep properties appear to be unaffected by hydrogen, but at 1700°F deleterious effects are observed. Tensile tests were used to evaluate the influence of carbon on the rupture ductility of this material. It was found that significant reduction in ductility occurred as the carbon content was increased. It was found that copper plating effectively reduced the rate of carburization at 1300°F. The service life of copper films at higher temperatures was seriously limited. Several general remarks are made relative to conceivable compatibility problems during reactor operation associated with the type 304 stainless steel cladding. It is felt that the most serious problem is associated with carburization and the subsequent distribution of carbon in the metal. (auth)

30798 (ORNL-3303) SIZE EFFECTS AND INTERSTITIAL IMPURITIES IN Nb_3Zr SUPERCONDUCTORS. SUPERCONDUCTING SOLENOIDS WITH METAL INSULATION. J. O. Betterton, Jr., G. D. Kneip, Jr., D. S. Easton, and J. O. Scarbrough (Oak Ridge National Lab., Tenn.). Sept. 11, 1962. Contract W-7405-eng-26. 37p.

Small additions of oxygen and carbon were found to increase the critical currents of Nb_3Zr wires in the precipitated condition. Wires of Nb_3Zr were prepared in various diameters by cold drawing, etching, and grinding. Each wire was made so that the cold working was the same at each final size. Under these circumstances, critical currents were nearly proportional to wire diameters, and strong increases in the critical-current densities occurred with smaller sizes, particularly in wires thinned by etching. The critical-current density of an 0.0009-in. wire was 3.3×10^5 amp/cm^2 at 25000 gauss. A second series of experiments varied the amount of cold working while keeping the final wire diameter constant. The cold working of precipitated Nb_3Zr wire beyond 90% decreased critical-current density slightly. The results are discussed in terms of filamentary current models with the conclusion that most of the current is near the surface of the wire. Two superconducting Nb_3Zr solenoids were built with pure metal foils between layers and with alloy or no insulation between turns. The transition times range between 6 and 30 sec at peak fields, 22 to 31 kilogauss, to 10 to 15 msec at 10 to 15 kilogauss. The second coil was wound with Nb_3Zr wire which had been precipitated at 800°C. The critical coil currents ($8^2 \times 10^4$ amp/cm^2 at 22000 gauss) agreed excellently with short-wire tests of the same wire. (auth)

30799 (ORO-573) HEXAGONAL NETWORKS OF LINEAR IMPERFECTIONS IN SINGLE CRYSTALS OF CADMIUM. J. C. Crump, III and J. W. Mitchell (Virginia, Univ., Charlottesville). July 31, 1962. Contracts AT(40-1)-2488 and NONR-474-05. 11p.

The formation and properties of a type of hexagonal network in thin crystals of cadmium are described. The networks appear almost immediately after the disappearance of vacancy-type loops introduced by bombarding the crystals with negative ions in the electron microscope. They lie in basal planes and the directions of the three sets of intersecting lines are parallel to the $(\bar{1}100)$ directions in the planes. Mobile specks which are attributed to clusters of interstitial atoms were also observed. (auth)

30800 (PWA-1877) DETERMINATION OF THE EMISSIVITY OF MATERIALS. Progress Report, July 1, 1960–September 30, 1960. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contract NASW with Amendment 1. 73p.

The total emittance of nine materials was measured at temperatures ranging up to 2200°F and at pressures of as low as 10^{-9} mm Hg. The specimens tested included sandblasted molybdenum, zirconium oxide, boron carbide in synar binder, aluminum phosphate with iron oxide, titanium oxide, titanium oxide and aluminum oxide, crystalline boron, platinum black, and chromium black. Titanium oxide and titanium oxide and aluminum oxide had emittances between 0.8 and 0.9 and aluminum phosphate had an emittance between 0.7 and 0.8. The results of the testing of the other specimens were compatible with the results of previous tests on the same materials. Endurance tests were also conducted on some of these specimens at various temperature levels. An investigation was made on the spectral emittance rig into the quality of the black body hole radiation. In this connection the effects of temperature perturbation and black body hole size were studied. This demonstrated the desirability of using specimen tubes with high thermal conductance and the necessity of having tubes of uniform emissivity and wall thickness. (auth)

30801 (PWA-1878) DETERMINATION OF THE EMISSIVITY OF MATERIALS. Progress Report, October 1, 1960–December 31, 1960. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contract NASW-104 with Amendment 1. 71p.

The total emittance of eleven materials was measured at temperatures up to 2000°F and at pressures as low as 10^{-9} mm Hg. The specimens tested had surfaces of platinum black, oxidized nichrome, chromium black, sandblasted molybdenum, chromic oxide, Krylon Black, titanium oxide, tantalum boride, titanium carbide, vanadium carbide, and molybdenum diboride. Of seven of the materials: oxidized nichrome, chromic oxide, Krylon Black, tantalum boride, titanium carbide, vanadium carbide, and molybdenum diboride, only chromic oxide had a total emittance higher than 0.80. Endurance tests were conducted on three of the specimens. (auth)

30802 (PWA-1966) DETERMINATION OF THE EMISSIVITY OF MATERIALS. Progress Report, January 1, 1961–March 31, 1961. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Contract NASW-104 with Amendment 1. 53p.

The design and performance of an aluminum plate thermal cycling rig and a new rig for endurance testing of finned-tube radiator sections are discussed. The total emittance of six materials was measured at various temperatures in a high vacuum. The specimens tested had surfaces of zirconium oxide, lithiated and oxidized nickel "C," acetylene black, oxidized nichrome, Krylon Black, and calcium fluoride. Lithiated and oxidized nickel "C" had a total emittance higher than 0.80. Endurance tests were conducted on the acetylene black and oxidized nichrome coatings. (auth)

30803 (TID-11432) SOME PRELIMINARY METALLOGRAPHIC STUDIES OF MATERIALS FOR USE ABOVE 2500°C. C. G. Hoffman (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-Eng-36]. 13p. (LADC-4259)

Studies are being made on materials for use above 2500°C. These include carbides, nitrides, silicides, borides, and intermetallic compounds. Techniques for polishing these materials are described. Etching and x-ray phase identification are discussed. (M.C.G.)

30804 (TID-15640) AN EVALUATION OF THE ROLE OF DEFORMATION TWINNING IN THE PLASTIC DEFORMATION OF ZIRCONIUM. Third Quarterly Progress Report. R[obert] E. Reed-Hill (Florida. Univ., Gainesville. Engineering and Industrial Experiment Station). Apr. 1962. Contract AT(38-1)-252. 49p.

Twinning in tensile specimens of both pure zirconium and Zircaloy-2 deformed at 77°K is much more complicated than at room temperature. At ambient temperatures the major deformation modes are prism slip and $\{10\bar{1}2\}$ twinning. At 77°K $\{11\bar{2}1\}$ becomes another major mode. Second order twinning or twinning inside twins is a phenomenon of common occurrence at this temperature. A study of the second order twinning deformation in $\{10\bar{1}2\}$ twins of pure zirconium was made. Zig-zag or cross-twinning in zirconium was also analyzed and found to involve $\{11\bar{2}1\}$ twins. Room temperature measurements of the volume fraction twinned were made for both zirconium and Zircaloy-2 tensile and creep specimens. The measurements show that in all cases the amount of twinning increases with the overall strain usually in direct proportion (strains less than 10%). Room temperature creep data are given for both zirconium and Zircaloy-2. The data show that the creep rate is a sensitive function of the specimen orientation. (auth)

30805 (TID-16527) THE FREQUENCY OF ANNEALING TWINS. Report for the Period, June 15, 1961 to June 15, 1962. D. J. Mack, D. J. Murphy, and J. R. Hancock (Arizona. Univ., Tucson. Coll. of Mines). Contract AT(11-1)-1040. 94p.

The frequency of annealing twins as a function of grain size (0.01 to 0.20 mm mean grain diameter) was determined in recrystallized specimens of copper, dilute copper-base alloys of Zn, Ag, Al, Sn, Ni, and Si, and in a series of commercial brass compositions. Mean twins/grain, mean twins/twinned grain, mean twin families/twinned grain, and percentages of grains twinned were determined as a function of grain size. The mean twins/grain versus mean grain diameter curves of all alloys examined experienced a maximum value of mean twins/grain at some intermediate grain size, while the total number of twins continuously decreased with increasing grain size. No correlations were found between twinning frequency and the usual alloying parameters, or stacking fault energies. Statistical analyses of the twin frequency data were performed for all three series of alloys. The results showed that the largest source of error was between observers, and that quantitative comparisons cannot be made between the data of individual observers. (auth)

30806 (TID-16573) APPLICABILITY OF ROUTINE METHODS OF CRYSTALLITE SIZE ANALYSIS. Robert C. Rau (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). [1962]. Contract [AT(11-1)-171]. 21p. (TM 62-7-9)

The applicability of routine methods of crystallite size analysis to other x-ray diffraction units was evaluated. A series of six beryllium oxide powder specimens, whose average crystallite sizes ranged stepwise from about 35 to nearly 3000 Å, were used to test a number of x-ray diffractometers. By using a predetermined diffraction geometry for each instrument tested, measured crystallite sizes were found to be quite reproducible and well within the limits of experimental error. The testing procedure, instrumental conditions, and individual performance results are presented. (auth)

30807 (TID-16574) AN EVALUATION OF THE ROLE OF DEFORMATION TWINNING IN THE PLASTIC DEFORMATION OF ZIRCONIUM. Fourth Quarterly Progress Report. R. E. Reed-Hill (Florida. Univ., Gainesville. Engineering and Industrial Experiment Station). July 1962. Contract AT(38-1)-252. 36p.

A contractile strain ratio analysis was applied to both zirconium and Zircaloy-2 specimens plastically deformed in tension and creep. The data indicate that the contractile strain ratios are essentially temperature-independent between 20 and 500°C and are independent of strain rate variations over a range of three or more orders or magnitude. On this basis, it appears that there may be no significant change in deformation modes within the investigated ranges of temperature and strain-rate. However, 540°C tensile specimens show less visible evidence of deformation twinning than do room-temperature specimens. This observed discrepancy in deformation characteristics may be due either to complete twinning of grains or to annealing-out of twinned material during relatively slow cooling from the test temperature. Banding in schedule-18 Zircaloy-2 was studied in detail. Unusually large scatter in creep-rupture life, creep rate, and contractile strain ratio data, observed with some specimens, may be explained in terms of a corresponding variation in the degree of banding. (auth)

30808 (UCRL-6937) CHARACTERIZATION OF LOW-TEMPERATURE FAILURES IN SILICIDE COATINGS. Gerald F. Rynders (California. Univ., Livermore. Lawrence Radiation Lab.). June 8, 1962. Contract W-7405-eng-48. 11p.

In the course of examination of the oxidation of silicide coatings on a niobium-rich alloy, a type of failure was observed that is related to the presence of mosaic cracks in the coatings. This mode of failure occurs at temperatures above about 500°C, and is distinct from the mode of failure known as the silicide pest. Other modes of failure may also exist in this same temperature region. In mosaic-crack failure, oxidation occurs preferentially at the intersection of cracks with the base metal. A swelling of the base metal occurs as a result of the oxidation. This leads to stresses between the coating and the base metal, which finally results in spalling. The failure is characterized by a remnant mosaic pattern left on the base metal. (auth)

30809 (UCRL-9593) DISLOCATION SUBSTRUCTURES IN DEFORMED AND RECOVERED MOLYBDENUM. R. Benson, G. Thomas, and J. Washburn (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 1961. Contract W-7405-eng-48. 32p.

Specimens suitable for transmission electron microscopy were prepared from bulk polycrystalline molybdenum after tensile deformation and recovery. The resulting dislocation substructures are described. Some tentative conclusions concerning the mechanism of plastic deformation in molybdenum are discussed. (auth)

30810 (WADD-TR-61-72(Vol.VI)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME VI. CREEP OF CARBONS AND GRAPHITES IN

FLEXURE AT HIGH TEMPERATURES. E. J. Seldin (National Carbon Co. Research Lab., Parma, Ohio). Dec. 1961. Contract AF 33(616)-6915. 34p.

Flexural creep tests were made on molded carbons and several types of graphites over the temperature range from 2200 to 3000°C. The amount of creep was found to decrease for a carbon as the temperature of graphitization increased and as the holding time at graphitization temperature increased for times up to four hours. Activation energies were determined for several standard and experimental grades of graphite from the steady state creep rates. The activation energies ranged from 23 to 92 kcal/mole and appeared to be constant for each graphite. The flexure experiments demonstrated a marked dependence of the creep on the grain orientation for the more anisotropic graphites. The grain orientation showing the highest room temperature strength shows the lowest high temperature creep. Some of the factors which influenced the creep behavior are density, crystallite size, and the size, type, and orientation of the particles. (auth)

30811 (AEC-tr-5296) ERBIUM AND ITS ALLOYS. E. M. Savitskiĭ, V. F. Tereknova, and O. P. Naumkin. Translated from Tsvetnye Metally, 1: 43(1960). 9p. (Includes original, 6p.)

Chemical and physical properties of metallic erbium of 99.3% purity are reported. It was established that erbium in the amount of 5% is miscible with aluminum, magnesium, iron, and titanium with formation in all cases of two phase mixtures of the eutectic or peritectic type. Erbium appears as a good modifier and hardening agent for the alloys. Erbium does not mix with tantalum. X-ray analysis confirm hexagonal structure of erbium with the lattice constants a = 3.55 Å, c = 5.58 Å, and c/a = 1.57. (N.W.R.)

30812 (AEC-tr-5312) [PART] I. THEORY OF THE ANOMALIES OF ELECTRICAL RESISTIVITY OF THE RARE EARTHS. Joseph Seiden. Translated by F. A. Smidt and L. C. Smidt (Ames Lab., Ames, Iowa). [PART] II. THE INTERACTION BETWEEN MAGNETIC IONS AND CONDUCTION ELECTRONS IN THE RARE EARTHS. Joseph Seiden. [PART] III. THEORY OF THE ELECTRICAL RESISTIVITY OF Gd. Joseph Seiden and M. Papoular Translated from Compt. rend., 252: 1922-; 3550-; 253: 812-(1961). 17p.

A theory of the anomalies of the electrical resistivities of rare earths is presented which is valid for $T > T_{c/3}$ where T_c is the Curie temperature. Experimental results were compared with those provided by the theory in the paramagnetic region. The order of magnitude of the intensity and range of the interaction between the magnetic ions and the conduction electrons for the rare earths investigated were thus determined. The theory of the electrical resistivity anomalies of certain rare earths in the ferromagnetic region was developed, and theoretical results were compared with experimental results. (M.C.G.)

30813 (EURAEC-359) EVALUATION OF GAS RELEASE CURVES ATTAINED DURING PAD EXPERIMENTS. I. MULTI-TEMPERATURE ANNEALS WITH F < 0.2. Technical Report No. 3, November 11, 1961–March 12, 1962. P. Schmeling (Hahn-Meitner-Institut für Kernforschung, Berlin).

Work Performed under United States–Euratom Joint Research and Development Program. Contract 064-61-8-RDD. 14p. A translation of EU-B-13.

Discussion is given on the measurement of the accumulated release of fission gases during a PAD experiment, where the temperature is often successively increased and an initial burst of release is observed. The method used for the evaluation of such release curves is demonstrated. A fictitious case is presented and various methods of evaluation are used. It is shown that the only reliable method is to plot the release, F, as a function of the square root of time, whereby the initial burst may be determined and subtracted from the primary data. The treatment presented is dependent upon the existence of more bursts. False plotting of the initial burst may cause the interpretation that each temperature increase induces a new burst, which need not be the case. (auth)

30814 (EURAEC-360) RELEASE OF FISSION RARE-GAS DURING PAD HEATING AS A RESULT OF CHEMICAL INTERACTIONS AND ITS FALSE INTERPRETATION AS BEING DIFFUSION. Technical Report No. 4, November 11, 1961–March 12, 1962. P. Schmeling (Hahn-Meitner-Institut für Kernforschung, Berlin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 064-61-8-RDD. 47p. A translation of EU-B-14.

Experimental difficulties encountered when measuring the diffusion of fission gases are pointed out. Release patterns in cases of obvious specimen corrosion are shown and compared with the expected form of a release curve. It is demonstrated that a false interpretation of a release curve may give too high a value of diffusion coefficient, and that there is no obvious way of discovering if a certain release pattern is caused by pure diffusion or not. Results on xenon release from uranium metal are cited, as well as preliminary data on xenon release from PAD heated uranium monocarbide. A critical review is also given for rare-gas diffusion from UO_2 powders and single crystals. (auth)

30815 (EURAEC-361) PRELIMINARY RESULTS ON THE RELEASE OF XENON-133 FROM URANIUM MONOCARBIDE POWDER. Technical Report No. 5, November 11, 1961–March 12, 1962. P. Schmeling (Hahn-Meitner-Institut für Kernforschung, Berlin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 064-61-8-RDD. 14p. A translation of EU-B-15.

The release of Xe^{133} from coarse powders of uranium monocarbide was measured, and in most cases acceptable release curves resulted. When heated for the first time, a pronounced burst of activity was noted, but successive temperature increases did not result in new bursts. However, if the temperature is raised above 1400°C, a distinct burst is noted, which may be caused by a beginning sintering. The activation energy of the diffusion process is estimated to be about 67 kcal/mole. (auth)

30816 (EURAEC-362) PRELIMINARY RESULTS ON THE RELEASE OF XENON-133 FROM URANIUM MONOCARBIDE. Technical Report No. 6, June 1, 1961–March 2, 1962. P. Schmeling (Hahn-Meitner-Institut für Kernforschung, Berlin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 064-61-8-RDD. 20p. A translation of EU-B-16.

The release of Xe^{133} from bulk uranium monocarbide was studied at 950–1900°C in vacuum, whereby the chemical reaction between the specimen and the surrounding materials was avoided as much as possible. It was noted that tantalum reacts with UC. When heated for the first time, a burst of activity was registered. Successive temperature increases resulted in some cases in a new burst, in other cases no new burst was noted. An activation energy of about 70 kcal/mole was calculated for the temperature interval 950–1600°C. (auth)

30817 (NP-tr-919) STUDY ON LATTICE DEFECTS IN GRAPHITE BY NUCLEAR FISSION PRODUCT RARE

GASES. S. Ichiba. Translated by S. G. Brickley (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nippon Genshiryoku Gakkaishi, 3: 763-6(Oct. 1961). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 2230.

30818 PROPERTIES OF URANIUM CARBIDES. Walston Chubb and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Am. Ceram. Soc. Bull., 41: 564-9 (Sept. 15, 1962).

Properties of uranium carbides are reviewed and brought up to date. Photographs and photomicrographs of uranium carbides fabricated by melting and casting techniques and by powder metallurgy techniques are presented. Recent data confirm that uranium monocarbide has metallic conductivity (a thermal conductivity of approximately 0.055 cal/sec-cm-°C and a resistivity of approximately 35 microhm-cm) and that it has the strength and hardness of ionic materials (a compressive strength of 51000 psi, a transverse rupture strength of 10000 psi, and a hardness of 700 kg/mm^2). The corrosion resistance of uranium carbides is poor in water, but is good in hydrocarbons. Uranium monocarbide is compatible with aluminum, copper, magnesium, mild steel, and zirconium to the maximum temperatures of usefulness of these metals as structural materials. It is not compatible with Inconel or stainless steel at 800°C. Uranium monocarbide shows no gross structural damage after irradiation to a burnup of 25000 Mwd/t of uranium at 600°C. Heat treatment is shown to markedly affect the microstructure and properties of alloys containing 7 and 9 wt % carbon. Minor alloy additions of the refractory metal carbides greatly improve the strength, hardness, and corrosion resistance to uranium monocarbide. (auth)

30819 THE STRENGTH OF NICKEL AT ROOM TEMPERATURE AND AT HIGH TEMPERATURES AS AFFECTED BY THE PARTICULAR STRUCTURAL STATE WHICH OCCURS DURING A HIGH-TEMPERATURE THERMO-MECHANICAL TREATMENT. M. G. Lozinskii, E. I. Antipova, E. A. Assonova, and I. I. Nikitina (Maschine Inst. of the Government Committee of the Council of Ministers on Automation and Machine Building, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1289-92(June 1962). (In Russian)

Austenitic alloys can be strengthened by a "high-temperature thermomechanical treatment" (HTT) which consists of the following: holding at a high-temperature to obtain a homogeneous solid solution (about 1200°C for most austenitic alloys and high-heat-strength alloys); cooling to 900-1100°C in treating a steel alloy, and to 500 to 900°C in strengthening nickel; plastic deformation with a reduction of about 25 to 35%; cooling to fix the specific structural state formed during the hot plastic deformation; and dispersion hardening or aging by precipitation of a carbide or intermetallic compound. The control samples were cooled directly from 1200°C by plunging in water. Microstructural photographs of technical-grade nickel subjected to high-temperature (900°C) hot rolling at 6.7 m/min show that the grain boundaries are more "saw-toothed" as compared to the control samples. The structure of the treated sample hinders the propagation of cracks. In testing the long-term strength of the nickel samples, a stress $\sigma = 31.2$ kg/mm^2 was used at 400°C, and $\sigma = 10$ kg/mm^2 was used at 600°C. The time for failure of the treated sample as compared to the control sample was greater by a factor of 118 at 600°C, 19 at 700°C, 18 at 800°C, and 12 at 900°C. A 43 to 63% increase in yield strength is observed with a thermal treatment of the sample at 600°C. As compared to the controls, the treated nickel samples showed an increase in the yield point of 134 to 203% at 400°C, and of 195 to 256% at 600°C hot rolling. The thermal treatment increases the strength of the nickel and improves its plastic properties. (TTT).

30820 THE EFFECT OF GROUP V ELEMENTS (V, Nb AND Ta) ON THE PROPERTIES OF THE INTERMETALLIC COMPOUND Fe_3Al. R. S. Mints, N. N. Samsonova, and Yu. S. Malkov (Baikov Inst. of Metallurgy, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1324-7(June 1962). (In Russian)

One of the methods of overcoming the brittleness of an intermetallic is by addition of an alloying constituent. Small amounts of V, Nb, and Ta were added to $FeAl_3$ to improve its high heat strength. The alloying ingredients have a limited solubility in Fe_3Al (5 wt. % for vanadium, 2% for Nb, and 2% for Ta). The hardness of Fe_3Al increased with increasing content of V, Nb, or Ta, but the Ta alloys showed the highest hardness. The specific electrical resistance of Fe_3Al increased sharply with the addition of 1.0 wt.% of alloying component, and then increased slowly with a further increase in content of V, Nb, or Ta. Alloys quenched from 1200°C had a greater electrical resistance than the slowly-cooled alloys. The vanadium alloys had the highest electrical resistance. A study of the hot hardness of the alloys showed that the rate of decrease in heat strength of the alloy decreased with an increase in content of V, Nb,or Ta. An alloy containing 10 wt.% Ta (2.83 at.%) showed the highest hardness with the lowest rate of decrease in heat strength of the alloy. The same alloy also possessed the highest hardness over a temperature range of 20 to 800°C. (TTT)

30821 THE EFFECT OF ALLOYING ELEMENTS ON THE SUPERCONDUCTING PROPERTIES OF V_3Si. N. E. Alekseevskii, E. M. Savitskii, V. V. Baron, and Yu. V. Efimov (Baikov Inst. of Metallurgy and Inst. of Physical Problems, USSR). Doklady Akad. Nauk S.S.S.R., 145: 62-4 (July 1, 1962). (In Russian)

The compound V_3Si with a critical temperature $T_{cr} = 17°K$ forms a continuous series of solid solutions with Mo_3Si which has a critical temperature $T_{cr} = 1.2°K$. A series of 14 alloys containing 0 to 75 at. % of V and 0 to 75 at. % of Mo were fused in an arc furnace with a non-consumable tungsten electrode in a helium atmosphere. X-ray and structural analyses showed that a continuous series of solid solutions were formed between V_3Si and Mo_3Si. The lattice constant of the $(V,Mo)_3Si$ solid solution increases from $a = 4.727$ for V_3Si to $a = 4.893$ Å for Mo_3Si. The critical temperature of the superconducting alloy falls rapidly with increasing concentration of molybdenum in the alloy. The addition of small amounts of beryllium, boron, or manganese to pure V_3Si did not give any increase in the critical temperature of the superconducting alloy. (TTT)

30822 AN INVESTIGATION OF EQUILIBRIUM IN ALLOYS HAVING AS A BASE A γ-SOLID SOLUTION OF Fe–Cr–Ni–Mn–Nb–V–Si. F. N. Tavadze, L. I. Pryakhin, and T. V. Simonishvili (Baikov Inst. of Metallurgy, USSR). Doklady Akad. Nauk S.S.S.R., 145: 112-14(July 1, 1962). (In Russian)

A simplified method of investigating and expressing the phase diagram of a multi-component system was selected by taking an unsaturated multi-component solid solution as a base. A seven-component γ-solid solution consisting of 58.5 wt % Fe, 15 wt % Cr, 15 wt % Ni, 10 wt % Mn, 0.5 wt % Nb, 0.5 wt % V, and 0.5 wt % Si was taken as the base solution. Variable amounts of titanium, aluminum, and tungsten

were added to this base alloy. The microstructure, hardness, microhardness, the specific electrical resistance and heat strength were investigated. The solubility of Ti, Al, and W in the base alloy were determined from the data. The phase diagram at 1100°C is given. The maximum solubilities in the base alloy are 2.8 wt % for Ti, 3.5 wt % for Al, and 5.5 wt % for W. The solubility decreases when Ti is added with Al, or Ti with W, and also an addition of Al with W. The exact composition of the solid phases was not determined, but will be investigated. (TTT)

30823 THE SYNTHESIS AND STUDY OF THE PHYSICAL CHEMISTRY OF OXYGEN COMPOUNDS IN THE MoO_3–MoO_2 SYSTEM. E. Ya. Rode and G. V. Lysanova (N. S. Kurnakov Inst. of General and Inorganic Chemistry, USSR). Doklady Akad. Nauk, S.S.S.R., 145: 351-4(July 11, 1962). (In Russian)

Differential thermal analysis, x-ray analysis, and a microscopic study of the compounds in transmitted and reflected light were carried out in order to investigate the composition, nature and processes of formation of individual phases in the MoO_3–MoO_2 system. Samples of the trioxide which had been partially reduced by hydrogen at 450 to 600°C were also investigated. The phases that were definitely confirmed consisted of the following: MoO_3 (α), Mo_9O_{26} (ξ), Mo_9O_{26} (β'), Mo_4O_{11} (η), Mo_4O_{11} (γ), and $MoO_{2.80}$ (δ). Transitions of the η-phase to the γ-phase and of the ξ-phase to the β'-phase were found. The γ-phase forms on reacting MoO_2 and MoO_3 in various ratios, as shown by an endothermic effect at 620 to 650°C. The ξ-phase forms by reaction of MoO_3 with the γ-phase, as shown by an endothermic effect at 770 to 790°C. The monoclinic η-oxide Mo_4O_{11} is formed at 500 to 600°C in the form of a violet crystalline powder. X-ray analyses show that the γ- and η-oxides are individual phases. The η-phase is converted to the γ-phase at 818°C. The monoclinic β'-oxide Mo_9O_{26} is formed at 750°C. No other phases could be detected in noticeable amounts. (TTT)

30824 RECRYSTALLIZATION DIAGRAM OF VANADIUM. E. M. Savitskii, V. V. Baron, and Yu. V. Efimov (Baikov Inst. of Metallurgy, USSR). Doklady Akad. Nauk S.S.S.R., 145: 612-4(July 21, 1962). (In Russian)

The grain size of vanadium is related to the degree of deformation and to the temperature of the subsequent annealing process. After purifying with cerium in an arc furnace with a nonconsumable tungsten electrode in an atmosphere of pure helium, the initial vanadium contained 0.07% oxygen, 0.21% carbon, 0.01% nitrogen, and about 0.2% metallic impurities. The vanadium was cold-rolled without breaking to a high degree of deformation. The metal was cold-rolled with a 50% reduction and annealed in vacuum for 1 hour in order to break up the large-grain structure. The average grain size was 63 μ after this treatment. Samples were cold-rolled with reductions of 5, 10, 15, 25, 50, 75, and 90% without an intermediate anneal. The hardness of the initial vanadium is 120 kg/mm^2, and increases with increasing reduction (136 kg/mm^2 at 5% reduction, 156 kg/mm^2 at 25% reduction, and 165 kg/mm^2 at 50 to 95% reduction). The reduced samples were annealed in vacuum at 750 to 1300°C for one hour. The initial recrystallization temperature of vanadium decreases with increasing degree of deformation. It is 900°C at 5% reduction, 800°C at 50% reduction, and 775°C at 95% reduction. Recrystallization results in complete removal of the cold-rolled structure. The average grain size is about 20 μ. No increase in grain size is observed on annealing the cold-rolled samples at temperatures up to 1050°C, but a sharp increase in grain size is noted at 1100°C with the samples which had been reduced by 10%, and at 1200°C for the 15% reduced samples. The average grain size increases from 20 μ to 40 μ at an annealing temperature of 1200°C for the samples with 25% reduction. The optimum treatment of vanadium, which gives a fine-grained structure and good mechanical properties, is cold-rolling with a reduction of 50 to 95%, and an anneal at a temperature of 850 to 1050°C in an inert atmosphere. (TTT)

30825 THE USE OF GRAPHITE IN SPACE TECHNOLOGY. A. E. S. White (Morganite Research and Development Ltd., London) and R. K. Hurden. J. Brit. Interplanet. Soc., 18: 367-77(May–June 1962).

A comparison of the characteristics of graphite and other refractory materials shows that graphite has many points in its favor. The fundamental physical, chemical, and mechanical properties of conventional graphite are given, and methods of improving these (by densification, removal of impurities, and coatings) are considered. Some developments include pyrographite, graphite whiskers, artificial diamond, self-glazing mixtures, graphite cloth, and graphite-based thermocouples. Some design factors are indicated. (auth)

30826 A GENERAL SURVEY OF THE MATERIALS PROBLEM. A. J. Murphy (College of Aeronautics, Cranfield, Bucks, Eng.). J. Brit. Interplanet. Soc., 18: 320-8 (May–June 1962).

The nature of the environment in outer space and its significance for materials of construction of astronautical vehicles are considered. In the structure and especially the skin of the vehicle high temperatures are developed through aerodynamic heating on re-entry into the Earth's atmosphere. Experience with heat-resisting engineering materials is gained in gas turbine applications. The potential developments toward higher operating temperatures of alloys based on iron, nickel, and cobalt are approaching exhaustion. The next stage may use the higher-melting-point metals, especially molybdenum, niobium, and tungsten, non-metallics such as carbon and ceramics, or combinations of metals and ceramics. The refractory metals are capable of stressed serice at 1370°C and higher, if means of protection against oxidation can be found. On the same condition graphite can be used for still higher temperatures. For the ballistic missile, ablation of surface layers on the nosecone offers the best prospect of heat dissipation. The ablating substance may be an organic material, e.g., synthetic resin, or a ceramic compound. For longer spells at high temperatures, as in gliding space-vehicles on re-entry, the alternatives are thermal insulation by non-metallic surface coatings, and skins of metals having very high melting points. The major technical difficulties in applying the refractory metals to service at very high temperatures arise from their reactivity with ambient gases, especially oxygen, and their tendency to brittleness at low and moderate temperatures. Characteristics of materials that acquire special importance in astronautical applications are: thermal conductivity, specific heat, latent heats of fusion and evaporation, coefficient of thermal expansion, reactivity at high temperatures, sensitivity to irradiation, creep strength and resistance to high fatigue stresses at high temperatures, and mechanical properties at low temperatures. (auth)

30827 POLYMERS IN SPACE. N. H. Langton (National Coll. of Rubber Tech., Northern Polytechnic, London) and A. L. Soden. J. Brit. Interplanet. Soc., 18: 329-40 (May–June 1962).

Knowledge of high polymers (rubbers, plastics, and textiles) is reviewed, qualitative and approximate quantitative

values for some properties being tabulated. Inorganic polymers receive attention because of the need for extreme high-temperature resistance. One of the major uses of polymers in astronautics is as fuels for solid propellant rockets; factors affecting performance and some manufacturing problems are discussed. Suggestions for possible future applications of polymers as structural materials in astronautics are advanced. Other uses in astronautics are as ablative materials and for protective clothing and spacesuits. (auth)

30828 EFFECT OF PRESSURE ON THE RESISTANCE OF PYROLYTIC GRAPHITE. G. A. Samara and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys., 37: 471-4(Aug. 1, 1962).

The effect of pressure to several hundred kilobars was measured on samples of pyrolytic graphite of density 2.18 and 2.20. Measurements along the c axis show a relatively high resistance which decreases with increasing pressure and levels at high pressure, apparently due to strongly decreasing compressibility. Along the a axis the resistance is low, but increases at higher pressures apparently due to recrystallization. (auth)

30829 HIGH TEMPERATURE REACTIONS BETWEEN REFRACTORY URANIUM COMPOUNDS AND METALS. Seymour Katz (General Motors Corp., Warren, Mich.). J. Nuclear Materials, 6: 172-81(July 1962). (In English)

Solid-solid reactions of various metals (Al, Cr, Fe, Mo, Nb, Ni, Th, Ti, V, Zr, and 304 stainless steel) with refractory uranium compounds (UC, UC_2, and UN) were investigated at elevated temperatures. The rates of growth of reaction zones were measured, and the products of reaction of some of the more reactive systems were identified. (auth)

30830 EJECTION OF ATOMS FROM URANIUM BY FISSION FRAGMENTS. M. D. Rogers and J. Adam (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials, 6: 182-9(July 1962). (In English)

The numbers of atoms ejected from the surface of uranium metal by fission fragments leaving its surface were measured over a considerable range of neutron doses. The results indicate that the rate at which uranium is returned, by ejection from the collector to the parent uranium surface, becomes equal to the rate of evaporation from the surface when the collected layer is about 10,000 times thinner than the range of fission fragments in uranium. Possible mechanisms for re-ejection are discussed. Both the present and previously published experiments, when interpreted on this basis, indicate that the number of atoms ejected per escaping fission fragment is of the order of 2000. The exact nature of the surface in all the experiments reviewed did not appear to cause a significant change in this number. (auth)

30831 THE DECOMPOSITION OF THE γ-URANIUM BASE SOLID SOLUTIONS AS REVEALED BY X-RAY INVESTIGATIONS. O. S. Ivanov and Yu. S. Virgiliev (Metallurgical Inst., Academy of Sciences, Moscow). J. Nuclear Materials, 6: 199-202(July 1962). (In English)

Analysis of the x-ray patterns suggests that the decomposition of the γ solid solution of U–Mo alloys takes place by the formation of U_2Mo regions, ordered to a considerable degree and coherently bound to the initial γ solid solution on the (001) planes. In U–Nb and U–Zr–Nb alloys, the γ solid solution decomposes homogeneously at a relatively low temperature and low Nb concentrations and heterogeneously at higher temperatures and high Nb concentrations; in the first case the transformation is due to the formation of numerous highly dispersed precipitates of α uranium, in the second case the decomposition results from a limited number of centers and proceeds as diffusion continues. (auth)

30832 AN AUTORADIOGRAPHIC TECHNIQUE FOR THE STUDY OF TRITIUM IN METALS AND ITS APPLICATION TO DIFFUSION IN ZIRCONIUM AT 149° to 240°C. C. R. Cupp (International Nickel Co. of Canada, Ltd., [Toronto]) and P. Flubacher. J. Nuclear Materials, 6: 213-28 (July 1962). (In English)

Tritium was used in a novel way to obtain diffusion coefficients in zirconium at 240, 195, and 149°C. The specimens were prepared by electrolytically depositing a hydride layer from a tritiated water electrolyte on zirconium specimens. The 2 ml of electrolyte contained 220 curies of tritium. Details of the electrolytic cell and conditions of electrolysis are given. The tritium diffused into the specimens under closely controlled conditions of time and temperature and the distribution of tritium in the metal was then studied by autoradiographic techniques. Volume and grain boundary diffusion were studied and a number of segregation effects observed on the autoradiographs. The frequency factor for lattice diffusion of tritium in zirconium was found to be 1.53×10^{-3} cm^2/sec and the activation energy 9070 ± 600 cal/mole, compared with 7060 cal/mole reported for hydrogen in zirconium. The reason for the difference is discussed. The ratio of the diffusion coefficients $D_{Boundary}/D_{Lattice}$ at 149°C is less than 10^4. The significance of these and other findings is considered. (auth)

30833 HIGH TEMPERATURE SUBSTOICHIOMETRY IN URANIUM DIOXIDE. E. Rothwell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Materials, 6: 229-36(July 1962). (In English)

Metallographic examination of uranium dioxide compacts heated in vacuo or an inert atmosphere above 1800°C revealed the presence of bright inclusions of a second phase. The inclusions were identified as metallic uranium and it is inferred that they are formed on cooling and are not present as metallic uranium at high temperature. Above 1800°C in atmospheres of low oxygen pressure, uranium dioxide is assumed to lose oxygen to give a substoichiometric phase UO_{2-y}, the value of y increasing with increasing temperature. (auth)

30834 THERMAL EXPANSION OF STAINLESS STEEL—UO_2 DISPERSION-TYPE NUCLEAR FUEL PLATES. H. S. Kalish and F. B. Litton (United Nuclear Corp., New Haven). Materials Research & Standards, 2: 638-9(Aug. 1962).

The coefficient of thermal expansion of stainless steel–UO_2 was determined at temperatures up to 1050°C and compared with that of stainless steel without the UO_2 dispersion. The steel containing the UO_2 dispersion had a lower coefficient of thermal expansion than the steel without the dispersion. To perform these tests, a method was developed for making thermal expansion measurements in a vacuum dilatometer with thin sheet specimens instead of rod-type specimens. (auth)

30835 RELAXATION STRENGTH OF STEELS EI612 AND 20Kh1M1F1 UPON ELONGATION AND RUPTURE. L. Ya. Liberman (Polzunov Central Scientific Research Inst. for Turbines, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 4, 6-13(Apr. 1962). (In Russian)

After extended service at elevated temperatures, steel reinforcement units are subject to fracture caused by preferential stress concentrations, the notch sensitivity depends on the reserve plasticity of the steel. In order to further study this effect, the stress release of cylindri-

cal Cr–Ni–W–Ti steel specimens was tested under the following conditions: under initial stress for periods of 700 to 1000 hours, after which they were loaded up to the initial stress; cyclic relaxation to rupture of the specimens after repeated loadings; and alternating relaxation cycles up to a given plastic deformation. Cumulative plastic deformation of the austenitic steel EI612 caused an acceleration of the relaxation while in the perlitic 20Kh1MiF1 steel the resistance against relaxation increased and stress release slowed down until all the reserve plasticity was exhausted. (TTT)

30836 HEAT TREATMENT AND MECHANICAL PROPERTIES OF ALLOYS OF THE Ti–Mo–Al SYSTEM. V. N. Moiseev. Metalloved. i Termichesk. Obrabotka Metal., No. 4, 36-40(Apr. 1962). (In Russian)

Titanium alloys containing up to 9% of total Mo + Al in ratios of 3 : 1, 1 : 1, and 1 : 3 and binary Ti–Mo and Ti–Al alloys were prepared by remelting in a vacuum furnace. Mechanical tests carried out after 1-hour long annealing at 800°C indicated that an increase of the Al content results in an increase of the yield strength from 54 to 102 kg/mm^2 while the elongation is reduced to 9%; at the same time plasticity upon bending and toughness are reduced. Changes in the Mo content do affect this property. Measurements of the mechanical properties after quenching from 750, 800, and 850°C, followed by aging at 480 and 500°C for 4 and 16 hours showed a definite increase in the strength of alloys containing 2.5 to 3% Mo. Increasing the quenching temperature and lowering the aging temperature resulted in an increase of the yield strength and a slight reduction of the plasticity. Alloys containing 2.0 to 3.5% Mo and 0 to 2.5 Al or 6 to 8% Mo and up to 3% Al were found to possess the highest plasticity and could be satisfactorily strengthened by heat treatment up to strength of 140 to 160 kg/mm^2. (TTT)

30837 EFFECT OF AGING CONDITIONS ON THE AMOUNT OF THE RESIDUAL AUSTENITE IN FUELING APPARATUS. Yu. I. Kheĭfets and I. V. Oryshich. Metalloved. i Termichesk. Obrabotka Metal., No. 4, 59-61(Apr. 1962). (In Russian)

The effect of various aging conditions on the amount of the residual austenite in Cr–Mn–W and Mn steels was investigated together with changes of the crystal lattice parameters. Results indicated that the Cr–Mn–W steel retains a larger portion of the austenite than the Mn steel. Aging at 130°C for 24 hours did not have a noticeable effect on the austenite remaining after annealing at 160°C but aging at higher temperature reduces it. Annealing diminished the tetragonal character of the martensite and caused shrinkage of the dimensions of the specimens. The aging process caused the transformation of the martensite, a partial decomposition of the austenite, and redistribution of the stresses but these processes could not be brought to completion at 130°C. For materials to be used for the fabrication of fueling apparatus it is recommended that a treatment consisting of quenching at 160°C for 4 to 5 hours, followed by air cooling and aging at 160°C after the machining process be carried out. (TTT)

30838 RECRYSTALLIZATION OF MOLYBDENUM. G. V. Estulin and Yu. I. Demkin (Central Research Inst. of Ferrous Metallurgy, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 7, 2-3(July 1962). (In Russian)

Structural changes in cast Mo specimens were investigated after annealing the specimens for 1 hour at 1600°C in a vacuum or at 2000°C in a H_2 stream, followed by electropolishing and electroetching. It was found that the polygonic structure is retained after the heat treatment. The internal structure of the crystallites was improved by the migration of the sub-boundaries to the main grain boundaries. The selective recrystallization of cold-worked Mo specimens, treated to high deformation, is caused by this migration of the boundaries and by the fusion of individual crystallites having similar orientations. (TTT)

30839 THE HARDNESS OF NIOBIUM ALLOYS CONTAINING MOLYBDENUM AT TEMPERATURES UP TO 1600°C. O. S. Ivanov, V. Z. Tseĭtlin, L. I. Gomozov, and V. V. Larionov (Baĭkov Inst. of Metallurgy and Evening Machine Construction Inst., Moscow). Metalloved. i Termichesk. Obrabotka Metal., No. 7, 4-7(July 1962). (In Russian)

Changes in the hardness of Nb–Mo alloys were determined at temperatures up to 2000°C under a vacuum of 10^{-4} mm of Hg. It was found that in the 20 to 200°C range the hardness of all the alloys, except that of pure Nb and Nb + 10 at. % Mo decreases sharply; this is caused by the effect of admixtures, including the dissolved gases. At temperatures up to 900°C the alloy containing 50 at. % Mo has the highest hardness, while at still higher temperatures the maximum is shifted to the alloy containing 60 at. % Mo. In the 200 to 700°C range the hardness of alloys with 60 to 80 at. % Mo decreases unexpectedly, and the temperature coefficient of hardness has a negative value. An alloy with a composition close to that of $NbMo_3$ has the lowest temperature coefficient of hardness. Hardness at high temperatures is a function of the time of loading. (TTT)

30840 GALVANIC COATINGS FOR THE PROTECTION OF MOLYBDENUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. G. V. Kozlova, T. G. Smirnova, V. P. Molchanova, and Z. A. Tubyshkina (Central Research Inst. of Ferrous Metallurgy, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 7, 7-9(July 1962). (In Russian)

It was attempted to determine the conditions for depositing Cr–Ni and Cr–Ni–Co coatings on Mo to protect it against high-temperature exposures. The Mo was etched in a 70% H_2SO_4 solution at an anodic current density of 5 to 10 amp/dm^2. The Cr-plating solution contained 250 g/l of CrO_3 + 2.5 g/l of H_2SO_4 and deposition was carried out at 25 to 35 amp/dm^2. The higher current density yielded a shiny deposit. The mat coating formed under conditions of low current density was under less stress than the shiny one; this is important for service under suddenly changing temperatures. The Ni-plating solution contained 350 g/l $NiSO_4 \cdot 7H_2O$ + 5 g/l H_2SO_4. For plating with Ni + Co, $CoSO_4 \cdot 7H_2O$ was added to the Ni plating solution. Alloys containing 6, 12, and 50% Co were successfully deposited on Mo. (TTT)

30841 THE PROPERTIES OF GALVANIC COATINGS ON MOLYBDENUM. A. P. Gulyaev, G. V. Kozlova, V. P. Molchanova, and T. G. Smirnova (Central Research Inst. of Ferrous Metallurgy, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 7, 10-13(July 1962). (In Russian)

The thermal resistance of single-layer (Cr) and double-layer (Cr–Ni and Cr–Ni–Co alloys) electrodeposited coatings on Mo was investigated. It was found that the Cr–Ni double layer possesses the best resistance against high temperature exposure. This protective property is lost as the result of the diffusion of Mo to the surface after extended exposures. On the other hand, Mo coated with a single Cr layer withstood the largest number of thermal cycles. Increase of the thickness of the coating resulted in the increase of heat resistance and reduction of the ability to withstand repeated thermal cycling. For best overall results the use of a 25 to 50-micron thick Cr layer and a 200 to 250-micron thick Ni layer is recommended; this com-

bination was found effective for protecting the Mo against exposure to 1100°C for 300 hours. (TTT)

30842 STRESS RELEASE IN IRON–NICKEL–CHROMIUM ALLOYS AT ELEVATED TEMPERATURES. A. M. Borzdyka (Central Research Inst. of Ferrous Metallurgy, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 7, 24-6(July 1962). (In Russian)

The effect of the relative ratios of the basic components in the Fe–Cr–Ni ternary solid solutions on the stress-release mechanism at high temperatures was investigated, using round specimens which were hardened for obtaining a uniform grain size throughout the alloys. It was found that changes in the composition of the basic austenitic steels does not exert a noticeable influence on the stress release mechanism at relatively low rates but at high stress release rates the effect of the composition becomes more marked. Supplementary alloying of the system by W, Mo, or Nb increased the resistance against stress release. The alloys can be strengthened greatly if the individual elements are added in quantities sufficient to form carbides or intermetallic phases. These relaxation tests were carried out at 600 to 750°C at initial stresses of 15 and 10 kg/mm^2. (TTT)

30843 EFFECT OF HYDROGEN ON MECHANICAL PROPERTIES OF URANIUM. W. L. Owen (Atomic Weapons Research Establishment, Aldermaston, Ferks, Eng.). Metallurgia, 66: 3-6(July 1962).

Recently published work on the effects of hydrogen on the mechanical properties of uranium is reviewed with particular reference to the semi-brittle to ductile transition. A suggested mechanism of embrittlement based on the formation of a hydride of an impurity is discussed. (auth)

30844 SHIELDING MATERIALS. J. Harrison. Nuclear Eng., 7: 305-8(Aug. 1962).

The types and properties of materials used as biological and thermal shielding for stationary and mobile reactors, and as shielding in special applications such as for hot cells, neutron sources, and other radiation sources, are reviewed. Both standard shielding materials (Pb, Fe, concretes, Cd, boral, water, etc.) and specialized shielding materials are investigated. (T.F.H.)

30845 THE de HAAS-VAN ALPHEN EFFECT IN RUBIDIUM. K. Okumura and I. M. Templeton (National Research Council, Ottawa). Phil. Mag. (8), 7: 1239-41(July 1962).

The observation of well-defined oscillations in rubidium of known crystallographic orientation is reported. The data give an oscillation period of 6.13×10^{-9} gauss^{-1}. This result was obtained by averaging the values from each side of the magnetic field peak to eliminate errors due to any phase-shift or pick-up in the field measuring circuit. This corresponds to an external area of the Fermi surface of about 1.56×10^{16} cm^{-2}, a possible distortion in area of some 2%. The peaks in the oscillations are an incidental result of tuning the pick-up coil to resonate at 60 kc/s, which improves the signal-to-noise ratio in this range. (N.W.R.)

30846 EFFECT OF ISOTOPIC MASS ON VISCOSITY OF MOLTEN LITHIUM. N. T. Ban, C. M. Randall, and D. J. Montgomery (Michigan State Univ., East Lansing). Phys. Rev., 128: 6-11(Oct. 1, 1962).

The viscosity of the separated isotopes of molten lithium was measured by observing the damped oscillations of a torsion pendulum whose bob contained a spherical cavity filled with the material under test. For both Li^6 and Li^7, the viscosity varies approximately as exp(B/T) over the temperature range 180 to 300°C; B has the value 458°K for Li^6 and 631°K for Li^7. The viscosity of Li^6 is 4.18 ± 0.05 mP (millipoise) at 180.4°C, its melting point; of Li^7, 6.00 ± 0.05 mP at 180.7°C, its melting point. A linear interpolation for Li^{nat} (7.4% Li^6, 92.6% Li^7) gives 5.86 mP at 180.5°C, only slightly lower than the value of 6.02 mP reported earlier by Andrade and Dobbs. The ratio of the viscosity of Li^7 to that of Li^6 is 1.44 at the melting point, in contrast with the value of 1.08, the square root of the mass ratio, as predicted on simple theoretical arguments. Actually, a thorough dimensional analysis shows that the viscosity varies as $(mkT)^{1/2}$ times a complementary dimensionless function containing — among other arguments — the mass as a consequence of quantum effects. The function evidently depends strongly on these effects, as indicated not only by the present results on molten Li^6 and Li^7, but also by the results of others on other isotopically substituted liquids. (auth)

30847 IMPURITIES AND NUCLEAR SPIN RELAXATION IN ALUMINUM. L. C. Hebel, Jr. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 128: 21-30 (Oct. 1, 1962).

Both positive- and negative-temperature nuclear spin distributions are used to study the nuclear spin-lattice relaxation in zero external field at liquid helium temperatures in aluminum with controlled impurity content. The relaxation shows considerable deviation from previous theoretical predictions, which were based on the assumption of a single nuclear spin temperature. Most of the deviation is removed by introducing strong impurity effects at zero field, which results in cross relaxation within the nuclear spin system. In addition, the magnetic-field dependence of the relaxation is measured, and the results are compared to theoretical predictions. (auth)

30848 DETERMINATION OF THE ALLOTROPIC TRANSFORMATION HEAT IN TITANIUM, ZIRCONIUM AND THE ALLOY Ti + 6.5 PER CENT Cr. S. D. Hertzricken and B. F. Slyusar. Ukrain. Fiz. Zhur., 7: 439-42(Apr. 1962). (In Ukrainian)

Employing a differential calorimeter, the latent heat of allotropic transformation in titanium, zirconium, and Ti + 6.5 per cent Cr is determined. The respective values (795 ± 70), (712 ± 60), and (450 ± 50) cal/mole are found. The application of the differential calorimeter method for the determination of the allotropic transformation heat is limited, inasmuch as a standard must be selected for the investigated object, having the same or approximately the same specific thermal capacity over a sufficiently wide range of temperatures. However, the method proposed is simple, yields satisfactory precision, and can therefore be employed in a number of cases. (auth)

30849 STUDIES OF V–Mo–Si ALLOYS. E. M. Savitskii, V. V. Baron, Yu. V. Efimov, and E. I. Gladyshevskii (Baikov Inst. of Metallurgy and L'vov State Univ., USSR). Zhur. Neorg. Khim., 7: 1117-25(May 1962). (In Russian)

Phase studies were made of V–Mo–Si and the mechanical properties were analyzed. It was found that the third component inhibits the inlimited Mo diffusion into V. A second phase solid solution with a $(V, Mo)_3$ Si base appears at 2 at.% Si. Additions of Si improve V oxidation resistance but reduce plasticity. (R.V.J.)

30850 CONSTITUTION DIAGRAM OF OSMIUM–RUTHENIUM ALLOY. M. A. Tylkina, V. P. Polyakova, and E. M. Savitskii. Zhur. Neorg. Khim., 7: 1467-8(June 1962). (In Russian)

Microstructure, x-ray-diffraction, and phase analyses were made of Os–Ru alloys and constitution diagrams were

constructed. The x-ray analysis showed only hexagonal solid solution. The lattice parameters drop smoothly from Os to Ru. The alloy forms a continuous solid replacement solution with melting points dropping from Os, 3050°C, to Ru, 2250°C. (R.V.J.)

30851 CONSTITUTION DIAGRAM OF OSMIUM–RHENIUM ALLOYS. M. A. Tylkina, V. P. Polyakova, and E. M. Savitskii. Zhur. Neorg. Khim., 7: 1469-70(June 1962). (In Russian)

Melting point, lattice parameters, and hardness of Os–Re alloy were studied and a constitution diagram was constructed. The alloy forms a continuous series of solid solutions with melting temperatures smoothly increasing from the melting temperature of osmium (3050°C) to rhenium (3170°C). The x-ray analysis showed only hexagonal solid solutions with lattice parameters increasing with increased rhenium. (R.V.J.)

30852 STUDY OF DIFFUSION AND PRECIPITATION OF RARE GASES IN METALS. G. Brebec, V. Levy, J. Leterutre, Y. Quere, and Y. Adda (Commissariat a l'Energie Atomique, Paris). Prepublication Copy. 37p. (In French)

Solid solutions of rare gas-metal are prepared by electric discharge. The rare gas atoms are positioned in the lattice by substitution. Precipitation of the rare gases in the airholes is studied by optical and electron microscopy. Diffusion of the rare gases in the metal is also studied. Results show that the precipitation of the rare gases in the airholes followed by diffusion disturb the measure of the coefficient of diffusion. Nevertheless, it seems possible to utilize the geometric conditions for determining the coefficient of diffusion with precision. (N.W.R.)

30853 HIGH TEMPERATURE COMPOUNDS. A Data Book. Henry H. Hausner and Helen C. Friedemann. Yonkers, N. Y., General Astrometals Corporation, [1962]. 34p. $1.00.

Melting points and mechanical and physical properties of carbides, oxides, borides, and nitrides of high-temperature metals are given in the form of tables and graphs. (P.C.H.)

30854 FUELS AND MATERIALS DEVELOPMENT FOR ADVANCED REACTORS. J. F. Schumar and J. N. Siltanen (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Preprint Paper No. 34. New York, Engineers Joint Council, 1962. 30p.

The most promising fuels and materials being developed for use in advanced reactors are reviewed. They include bulk fuels such as UO_2 and UC, dispersion fuels such as UO_2 in BeO and UC_2 in a graphite matrix, and such improved systems as fuel particles with impervious coatings as represented by $(Th,U)C_2$ particles with pyrolytic graphite coatings. The nonmetallic fuel elements being developed for the Peach Bottom High-Temperature Gas-Cooled Reactor are discussed. (A.G.W.)

30855 STROENIE SPLAVOV NEKOTORYKH SYSTEM S URANOM I TORIEM. (Structure of Alloys with Uranium and Thorium Base). O. S. Ivanov, ed. Moscow, Gosatomizdat, 1961.

Thirty-five articles are included on the structure, phase transformation, and properties of alloys with U and Th base. Separate abstracts have been prepared for each. (R.V.J.)

30856 INVESTIGATIONS OF U–Zr ALLOYS. O. S. Ivanov and G. N. Bagrov. p.5-19 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

A continuous series of solid solutions was observed in the constitution diagram for γ uranium and β zirconium. The γ-solid solution separated into γ and γ_{Zr} phases (enriched with U and Zr respectively). The maximum separation was reached with 35 at. % Zr at 735°C. A monotectic transformation $\gamma \rightharpoonup \beta + \gamma_{Zr}$ took place at 695°C and 13 at. % Zr. The dissociation of β-uranium, $\beta \rightleftharpoons \alpha + \gamma_{Zr}$, took place at 662°C with δ_1 phase appearing below 615 to 607°C. The electric resistivity of U–Zr alloys (1000°C annealing and 500° tempering) was analyzed. (R.V.J.)

30857 CONSTITUTION DIAGRAM AND STRUCTURE OF U–Nb ALLOYS. O. S. Ivanov and G. I. Terekhov. p.20-34 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

The U–Nb constitution diagram exhibited a continuous series of solid solutions between U and Nb γ modifications. Below 1000°C γ solutions separated into γ and γ_{Nb} phases. The maximum separation was reached at U and Nb equilibrium. At 650°C γ- and β-solutions form a three phase equilibrium $\gamma \rightleftharpoons \beta + \gamma_{Nb}$ with an eutectic at 17 at. % Nb. The β transformation at equilibrium follows the eutectic reaction $\beta \rightleftharpoons \alpha + \gamma_{Nb}$ at 640°C. Niobium is practically insoluble in uranium. (R.V.J.)

30858 DISINTEGRATION OF γ-SOLID SOLUTION OF URANIUM AND NIOBIUM. O. S. Ivanov and Yu. S. Virgil'ev. p.35-47 of "Stroenie Splavov Nekotorykh System s Uranon i Toriem." Moscow, Gosatomizdat, 1961.

Dissociations of γ-solid solutions of U with 20, 30, 40, 50, 60, and 70 at. % Nb, annealed at 1000°C, were studied at gradually increased temperatures with 50-hour soaking. Homogeneous dissociations of γ-solid solutions with up to 30 at. % Nb form a heterogeneous two-phase system with 40 at. % Nb. The α-uranium phase separates forming metastable γ_1 phase. In turn, γ_1 phase transforms into another metastable γ_2 phase, a saturated γ_{Nb} equilibrium phase with 72 at. % Nb. Increased Nb effects the aging of the alloy. (R.V.J.)

30859 STUDIES OF THE U–Mo ALLOY STRUCTURE AND PROPERTIES AT 600 TO 1200°. O. S. Ivanov, T. A. Badaeva, A. T. Semenchenkov, and R. I. Kuznetsova. p.48-67 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

The constitution diagram and structure of U–Mo alloys were studied, and the observed tetragonal lattice of the γ-solid solutions was analyzed with the postulation that the transformation of the cubic lattice into the tetragonal is the result of an ordering reaction. The boundaries of solid solutions were determined on the basis of α, β, and γ-uranium modifications. An analysis of hardness indicated the softest alloy contained 10 to 12 at. % Mo. Further studies were made of the microstructure and constitution diagrams at 1000°C and various Mo contents. (R.V.J.)

30860 CONSTITUTION DIAGRAM AND STRUCTURE OF U–Mo ALLOYS AT 600° AND LESS. O. S. Ivanov, A. T. Semenchenkov, and N. I. Kozlova. p.68-86 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

An analysis is made of the δ_2 phase appearing at 600°C and of the coexistence of this phase with other phases in U–Mo alloys. (R.V.J.)

30861 TRANSFORMATION OF γ-SOLID SOLUTION IN U AND Mo ALLOYS. O. S. Ivanov and Yu. S. Virgil'ev. p.87-92 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Transformation kinetics of γ-solid solutions of 1000°C annealed uranium alloys with 20, 30, and 40 at. % Mo were studied at gradually increased temperatures with 50-hour

quenching at various temperatures. With increased temperature or soaking time the amount of δ_2 phase increased and γ-phase decreased. The phase transformation was completed at 500°C with 50 hours soaking. (R.V.J.)

30862 CONSTITUTION DIAGRAM OF U–Zr–Nb ALLOYS. RADIAL CROSS SECTION. O. S. Ivanov and L. I. Gomozov. p.93-106 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Phase diagrams were constructed for U–Nb–Zr alloys, and the distribution of γ-solid solutions at various temperatures and their stability with increasing temperatures or continuous tempering at 500°C were studied. (R.V.J.)

30863 CONSTITUTION DIAGRAM OF U–Zr–Nb, CROSS SECTIONS WITH CONSTANT U CONTENT, AND POLYTHERMAL DIAGRAM OF THE SYSTEM. O. S. Ivanov and L. I. Gomozov. p.107-27 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Microstructure and x-ray-diffraction analyses were made of 185 specimens annealed at various temperatures, and six polythermal constitution diagrams were constructed. At 1000°C uranium, zirconium, and niobium form continuous solid solutions. Thirteen monovariant and 3 nonvariant equilibria were formed at 685, 645, and 430°C. The dissociation regions ($\gamma + \gamma_{Zr}$), ($\gamma + \gamma_{Nb}$), and ($\gamma_{Zr} + \gamma_{Nb}$) taper off into ternary systems (2.5, 12.5, and 21.5 at. %, respectively). The solubility of Nb in the δ_1 phase does not exceed 2 at. %. The rapid tapering off in the dissociation regions is discussed. (R.V.J.)

30864 BEHAVIOR OF URANIUM–ZIRCONIUM–NIOBIUM ALLOYS IN ANNEALING AND TEMPERING. L. I. Gomozov and O. S. Ivanov. p.128-40 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Constitution diagram, hardness, and crystal structure studies of U–Zr–Nb alloys annealed at 1000°C indicate α-saturated solid solutions with an α-uranium base, γ' solid solutions with tetragonal lattices, γ-solid solutions with cubic lattices, α'-saturated solid solutions with an α-zirconium base, and metastable ω-phase zirconium with hexagonal structure, as well as intermediate regions. ($\alpha + \gamma$), ($\alpha' + \gamma'$), ($\alpha_{Zr} + \omega$), and ($\omega + \gamma$) (β). (R.V.J.)

30865 ISOTHERMAL CROSS SECTIONS OF U–Mo–Zr ALLOYS AT 1000 TO 625°. O. S. Ivanov and G. N. Bagrov. p.141-65 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Isothermal constitution diagrams were constructed for U–Mo–Zr alloys at 1000, 750, 700, 675, 650, and 625°C, and the effects of Zr and Mo solubility in γ uranium on the structure and properties of the alloys were analyzed. (R.V.J.)

30866 ISOTHERMAL CROSS SECTIONS AT 600, 575, AND 500°, POLYTHERMAL CROSS SECTIONS, AND CONSTITUTION DIAGRAM OF TERNARY U–Mo–Zr ALLOY. O. S. Ivanov and G. N. Bagrov. p.166-90 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Structures and isothermal cross sections of U–Mo–Zr alloys were studied below 1000°C. γ-solid solutions, annealed at 1000°C, transformed into a δ_4 phase or into mixed δ_4 with α, δ, α_{Zr}, or δ_3 phases after continuous 100 and 1000 hour quenching at 500°C. (R.V.J.)

30867 THE ANNEALING AND TEMPERING BEHAVIOR OF U–Mo–Zr γ-SOLID SOLUTIONS. O. S. Ivanov and G. N. Bagrov. p.191-8 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Continuous 100 and 1000 hour tempering of previously annealed (at 1000°) U–Nb–Mo alloys at 500°C transformed the γ phase into δ_4 or into mixed δ_4, α, δ_1, α_{Zr}, and δ_3 phases. Following 1000-hr tempering the highest hardness (550 kg/mm^2) was observed in alloys with 10 at. % Mo and 60 to 30 at. % U. (R.V.J.)

30868 POLYTHERMAL CROSS SECTIONS OF U–Nb–Mo CONSTITUTION DIAGRAM. O. S. Ivanov and G. I. Terekhov. p.199-213 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Constitution diagrams were constructed for binary U–Nb and ternary U–Nb–Mo systems and their properties as reactor fuel material were evaluated. The distribution of γ-solid solutions and corresponding transition of alloying components into active solvent states stable against radiation were studied. Phase equilibria at temperatures of γ-dissociation and transformation were also studied. The results show that Nb and Mo form a continuous series of solid solutions. (R.V.J.)

30869 ISOTHERMAL CROSS SECTIONS AT 560 AND 500° AND CONSTITUTION DIAGRAM FOR U–Nb–Mo ALLOY. O. S. Ivanov and G. I. Terekhov. p.214-27 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

The structure, phase composition, and hardness of U–Nb–Mo alloys at 550 to 500°C were studied as potential nuclear reactor material. Isothermal cross sections of various compositions were constructed. (R.V.J.)

30870 ISOTHERMAL CROSS SECTIONS AT 1200 TO 575° AND CONSTITUTION DIAGRAMS FOR U–Mo–Nb ALLOYS. O. S. Ivanov and G. I. Terekhov. p.228-48 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Microstructure, hardness, and phase analyses were made of U–Nb–Mo alloys, and isothermal cross sections were constructed for 1200 to 575°C. At 642°C the equilibrium $\gamma \rightleftharpoons \alpha + \gamma_{Nb-Mo}$ shifts from the existing peritectic reaction $\beta + \gamma \rightleftharpoons \alpha + \gamma_{Nb-Mo}$ toward the U–Mo side in the ternary system. With a further drop of temperature to 600 to 575° the homogeneous γ phase continues to diminish. (R.V.J.)

30871 ANNEALING AND TEMPERING TRANSFORMATIONS IN U–Nb AND U–Nb–Mo γ-SOLID SOLUTION. O. S. Ivanov and G. I. Terekhov. p.249-64 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Hardness of 1000°-annealed alloys with 3:1, 1:1, and 1:3 at. % ratios of Nb:Mo in the U ternary system and in uranium–niobium and uranium–molybdenum binary systems was studied. It was found that at 500°, during 100 and 1000 hour soakings, the disintegration of γ-solid solutions was much slower in ternary than in binary alloys. The best retention of γ phase was in alloys containing 80, 70, 60, and 40 at. % U with ratios of at. % Nb or Mo of 27:73. A total disintegration of γ solid solution was observed at 1100°C. The most stable in relation to γ phase and the strongest under continuous 500° treatment were alloys at the boundary of $\alpha + \gamma_{Nb-Mo}/\alpha + \gamma_{Nb-Mo} + \delta_2$ with 80 to 70 at. % U. Binary U–Nb alloys with 2 to 3 at. % Nb are capable of prolonged retention of a quasi-isotropic dispersion state at 400 to 500°C. (R.V.J.)

30872 STRUCTURE OF QUATERNARY U–Zr–Nb–Mo ALLOYS AT 1000 TO 800°. O. S. Ivanov and Yu. S. Virgil'ev. p.265-95 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Isothermal tetrahedrons were constructed for U–Zr–Mo–Nb alloys at 1000 and 800°C. It was found that in four

component alloys the γ solid solution phase is more stable than in limited ternary systems of U–Mo–Zr and U–Nb–Mo. In cross sections with 80, 70, and 60 at. % U the $\gamma \rightarrow \alpha$ martensite transformation adjacent to U–Zr is limited by alloying Mo and Nb. (R.V.J.)

30873 STABILITY OF ANNEALED γ-SOLID SOLUTIONS IN U–Zr–Nb–Mo ALLOYS AFTER CONTINUOUS ANNEALING AT 430 TO 550°. O. S. Ivanov and Yu. S. Virgil'ev. p.296-306 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

A complete transformation of γ-phase solid solution was observed in alloys with 70 to 80 at. % U after 100 hours of quenching, further tempering only coagulated the disintegrated structure. Alloying with 40 to 50 at. % Zr, Mo, and Nb slowed the transformation even after 1000 hours of quenching. (R.V.J.)

30874 NONMETALLIC INCLUSIONS IN URANIUM ALLOYS WITH ZIRCONIUM, NIOBIUM, AND MOLYBDENUM. Yu. S. Virgil'ev. p.307-11 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Metallographic identification of nonmetallic inclusions in U alloys with Zr, Nb, and Mo indicates the presence of uranium carbide in U–Mo alloys, NbC in U–Mo–Nb alloys, and ZrC in zirconium containing alloys. (R.V.J.)

30875 STRUCTURE OF U–Zr–Ti ALLOYS. A. T. Semenchenkov and O. S. Ivanov. p.312-24 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Phase studies were made of U–Zr–Ti alloys following 900°C annealing. It was found that the ternary γ solid solution, well distributed at 900°C, transforms into various phases depending on the composition: α', $\alpha' + \gamma$, $\gamma + U_2Ti$, α'_{Ti}, α'_{Zr}, ω, γ, $\gamma + \alpha'_{Zr\text{-}Ti}$, $\gamma + \omega$, and $\omega + \alpha_{Zr\text{-}Ti}$. A considerable variation in hardness was observed with the phase transformations. (R.V.J.)

30876 CONSTITUTION DIAGRAM FOR U–Mo–Cr ALLOYS. T. A. Badaeva and R. I. Kuznetsova. p.325-38 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Microstructure and thermal analyses were made of U–Mo–Cr alloys, and constitution diagrams were constructed for the temperature interval from 600 to 1080°C. At 800° the γ phase narrows from 33 at. % Mo in U–Mo alloy to 1.65 at. % Cr in U–Cr alloy. (R.V.J.)

30877 CONSTITUTION DIAGRAMS OF ALLOYS WITH THORIUM. T. A. Badaeva. p.339-57 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

A compilation is given of various constitution diagrams of thorium with various metals: U, Pu, Ce, Hf, Zr, Ti, Nb, V, Cr, Ni, Cu, Ag, Au, Be, Mg, Al, C, Pb, Bi, and Se. The structures and properties of the alloys are analyzed. (R.V.J.)

30878 STRUCTURE OF Th–Be ALLOY. T. A. Badaeva and R. I. Kuznetsova. p.358-68 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

The constructed thorium–beryllium constitution diagram exhibits an ffc-lattice $ThBe_{13}$ compound (92.86 at. % Be) with a melting point at ~1930°C. The $ThBe_{13}$ compounds are in eutectic equilibrium with thorium base solid solutions (α_{Th}). The eutectic is found near 38 at. % Be at 1240°C, and the peritectic point is near 0.03 at. % Th at 1330°C. Beryllium solubility in Th at 1150°C is less than 1 at. %; from 1250°C to room temperature it is less than 0.01 at. %. (R.V.J.)

30879 CONSTITUTION DIAGRAM OF Th–Zr ALLOYS. T. A. Badaeva and G. K. Alekseenko. p.369-80 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Constitution diagram, x-ray diffraction, microstructure, and hardness analyses showed that Th and Zr form a continuous series of solid solutions with minimums on the liquidus and solidus curves. It was noticed that Zr sharply reduces the temperature of thorium $\alpha \rightarrow \beta$ transformation. The presence of Zr eutectoid at 650°C and 86 at. % Zr indicates that Th solubility in Zr is less than 2.2 at. % and Zr solubility in Th is nearly 7 at. %. At 945°C and 54 at. % Zr the solid solution dissociates into two solid solutions with different Zr contents ($\beta_1 + \beta_2$). Monotectoid transformation $\beta_1 \rightleftharpoons \alpha_{Th} + \beta_2$ takes place at 920° and 40 at. % Zr, with 14 at. % Zr in the α_{Th} and 69.5 at. % Zr in β_2. (R.V.J.)

30880 CONSTITUTION DIAGRAM OF Th–Ce ALLOYS. T. A. Badaeva and R. A. Kuznetsova. p.381-6 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Continuous solid solutions were found between ffc modifications of initial specimens. The microstructure, hardness, and crystal lattice parameters of Th–Ce alloys annealed at 1000, 800, 600, and 400°C were studied. (R.V.J.)

30881 SOLUBILITY OF LEAD AND TIN IN SOLID SOLUTIONS OF THORIUM. T. A. Badaeva and R. I. Kuznetsova. p.387-94 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Studies of tin and lead solubilities in thorium solid solutions showed that at 1300°C to room temperature the solubility of tin is ~0.2 at. % and at 1400° to room temperature the solubility of lead is ~0.7 at. %. (R.V.J.)

30882 STRUCTURE OF Th–Zr–U ALLOYS. T. A. Badaeva and G. K. Alekseenko. p.395-415 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

A constitution diagram was constructed for Th–Zr–U alloys at 1000 to 500°C. A $\beta_{Th}\beta_{Zr}\gamma_U$ solid solution region, based on a vcc lattice was found at elevated temperatures. A dissociation of the $\beta_{Th}\beta_{Zr}\gamma_U$ solution into two ternary solid solutions ($\beta_{Th} + \beta_{Zr}$) with identical lattices but varied components is peculiar to the system. The uranium- or zirconium-rich solid solutions with vcc lattices were subject to transformation under 1000°-annealing. In the first case the transformed is to an orthorhombic α-uranium and in the second case, to a hexagonal α-zirconium plus an ω-phase with its own hexagonal lattice. Increased Th and U in the ternary systems prevented transformations in β_{Zr}-solid solutions. Concentration disintegration took place in Th-rich β_{Th} solid solution with 1 to 2 at. % uranium. (R.V.J.)

30883 COMBINED SOLUBILITY OF THORIUM AND URANIUM IN LIQUID BISMUTH. T. A. Badaeva and L. A. Rybakova. p.416-22 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Combined solubility of Th and U in liquid bismuth was studied at 300 to 1000°C. At 300° there are only traces of Th and about 0.1 at. % U. At 1000° the maximum saturation is 4.1 at. % Th and 7.5 at. % U. Two binary systems $ThBi_2$ and UBi_2 were found in equilibrium with the liquid at the above temperatures. (R.V.J.)

30884 STRUCTURE OF $ThBe_{13}$–UBe_{13} ALLOYS. T. A. Badaeva and R. A. Kuznetsov. p.423-7 of "Stroenie Spla-

vov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Microstructure, x-ray diffraction, and hardness analyses of annealed specimens revealed a continuous series of solid solutions between $ThBe_{13}-UBe_{13}$ in Th–Be–U alloys. (R.V.J.)

30885 INVESTIGATIONS OF THORIUM–URANIUM MONOCARBIDE. O. S. Ivanov and Z. M. Alekseeva. p.428-37 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Single-phase solid solutions of Th–UC were not observed in Th–U–C. Continuous solid solutions were observed between uranium monocarbide and thorium monocarbide. Further investigations of these solid solutions as reactor fuel material are suggested. (R.V.J.)

30886 INVESTIGATIONS OF THE STRUCTURE OF UC–ZrC, UC–ThC, AND ThC–ZrC SYSTEMS. O. S. Ivanov and Z. M. Alekseeva. p.438-49 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Phase studies of UC–ZrC, UC–ThC, and ThC–ZrC systems annealed at 500, 700, and 1100°C were studied to obtain preliminary data for ternary systems. Continuous solid solutions were observed between UC and ZrC with a maximum at 45 at. % Zr. The oxidation resistance of Zr-rich solutions with 5 to 10 at. % U was much higher than UC. Experiments confirmed the presence of continuous solid solutions between UC–ThC. However, ThC–ZrC do not form continuous solid solutions. The temperature dependent solubility of ZrC in ThC is quite limited, while ThC solubility in ZrC is nil. The chemical stability of the examined alloys in air at room temperature diminishes with increased ThC content. (R.V.J.)

30887 INVESTIGATION OF TERNARY UC–ThC–ZrC SYSTEMS. O. S. Ivanov and Z. M. Alekseeva. p.450-6 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

The single-phase boundary of ternary solid solutions at 2000°C to the melting point was determined. It is shown that the single-phase region is distributed along the two sides of the UC–ThC and UC–ZrC triangle, and intersecting at two points. The third side of ThC–ZrC is between ~50 and ~5 at. % Zr. The rest of the triangle contains a two-phase region. (R.V.J.)

30888 STRUCTURE OF THORIUM OXIDE WITH ZIRCONIUM OXIDE SYSTEMS. N. M. Voronov, A. S. Danilin, and I. T. Kovalev. p.457-66 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

A constitution diagram constructed on the basis of dilatometric, x-ray, and melting analyses of ThO–ZrO almost completely rejected published data on reactions between these two components. The components exhibit a tendency toward eutectic formation at 25 mole % ThO. However, the tendency is qualified by a considerable difference in cation magnitudes realized at lower temperatures through the disintegration of the solid solution formed in transition from the liquid to the solid state. The tendency of the solid solution toward disintegration depends on composition. Eutectoid transformations of tetragonal solid solution are induced by zirconium oxide polymorphism. (R.V.J.)

30889 CONSTITUTION DIAGRAMS OF URANIUM DIOXIDE–ZIRCONIUM DIOXIDE SYSTEMS. N. M. Voronov, E. A. Voltekhova, and I. T. Kovalev. p.467-81 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

An analysis of the constitution diagram for UO_2-ZrO_2 revealed continuous solid solutions with a fluorite lattice at 0 to 51.3 mole % ZrO_2; additions of ZrO transformed the fluorite lattice into a tetragonal lattice that is inherent to the ZrO_2 modification that is retained up to the crystallization temperature (1650°C). An increased concentration of UO_2 reduces the solid solution transformation temperature from tetragonal to monoclinic from 1040°C for pure ZrO_2 to ~140°C in systems with 14.0 mole % UO_2. (R.V.J.)

30890 REACTIONS OF URANIUM DIOXIDE WITH BARIUM OXIDE. N. M. Voronov and R. M. Sofronova. p.482-9 of "Stroenie Splavov Nekotorykh System s Uranom i Toriem." Moscow, Gosatomizdat, 1961.

Microstructure, thermal, and x-ray analyses were made of UO_2-BaO, and a constitution diagram was constructed. The binary UO_2-BaO system forms $BaUO_3$ with pseudocubic perovskite structure. The $BaUO_3$ and UO_2 form eutectic mixtures. BaO is not soluble in UO_2 solid solution. The presence of Ba_3UO_6 was observed in the $BaO-UO_3$ system. (R.V.J.)

30891 ZIRCONIUM BASE ALLOY. (to U. S. Atomic Energy Commission). British Patent 904,590. Aug. 29, 1962.

A Zr base alloy is described which has good corrosion resistance, high mechanical strength, and low temperature coefficient of mechanical strength. The alloy comprises 3 to 10% Al, 0.1 to 4% Mo, 0.05 to 1% Be, up to 1% B, and balance Zr. Examples of such an alloy are given. (D.L.C.)

30892 IMPROVED MAGNESIUM ALLOYS. Jeffrey Charles Edward Olds (to Associated Electrical Industries Ltd.). British Patent 904,906. Sept. 5, 1962.

A Mg alloy is described which resists oxidation by CO_2 or CO_2–air at 500°C and has good mechanical properties at 200 to 500°C for use as reactor fuel element canning. The alloy consists of 0.3 to 1.0% Zr, 0.05 to 0.5% Mn, 0 to 2.6% Zn, 0.011 to 0.5% Be, and balance Mg. The alloy is a development of the Mg alloys described in British Patent 851,871. (D.L.C.)

30893 THERMOELECTRIC COMPOSITION. Raymond Bowers and Roland W. Ure, Jr. (to Westinghouse Electric Corp.). U. S. Patent 3,054,842. Sept. 18, 1962.

A thermoelectric material of n-type and having a high figure of merit comprises the composition $A_xB_{2-x}C_2$, where A = Cd, Zn, and/or Hg, B = Sn, Ge, and/or Si, C = As, Sb, and/or P, and x = 0.5 to 1.5. The method of preparation of the material is given. (D.L.C.)

Radiation Effects

30894 (ANL-6585) POSSIBLE IMPLICATIONS OF THE DAMAGE BY RADIATION IN THE STORAGE OF PROPELLANTS IN OUTER SPACE AND TENTATIVE METHODS FOR ITS MEASUREMENT. J. A. McMillan (Argonne National Lab., Ill.). July 1962. Contract W-31-109-eng-38. 17p.

The damage by radiation that can be expected during the storage of H_2-bonded propellants in outer space is analyzed in terms of the available data on radiation levels. On this basis, the alternatives of storing the propellants as liquids or as solids, at low temperature, are discussed, and account is taken of recent results on their thermal behavior. Vitreous aggregation states of compounds that could crystallize spontaneously after long periods of irradiation are shown to present some hazards that can be prevented. General considerations of radiation-damage detection in outer space are also made. Paramagnetic resonance is found to be of little use in view of the relatively low-dose levels. Solid-state devices are recommended. (auth)

30895 (BNL-5120) RADIATION HARDENING. George H. Vineyard (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT(30-2)-Gen-16]. 64p.

The mechanisms behind the effects of radiation hardening are investigated and discussed. Radiation damage in metals occurs through primary collisions which suddenly give individual atoms rather large amounts of kinetic energy, wrenching them from their sites and plunging them forcibly into the surrounding lattice. Thus, radiation hardening in metals seems most likely explained by the assumption that numerous small obstacles to dislocation motion are introduced. A number of experiments are reviewed which shed light on underlying mechaniams. (N.W.R.)

30896 (BNL-5179) THE DYNAMICS OF RADIATION DAMAGE. G. H. Vineyard (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT(30-2)-Gen-16]. 59p.

Calculations of radiation damage to face-centered-cubic metallic crystals, in particular copper crystals, are presented to give a more intimate view of events occurring in the lattice at low and moderate energies. The results show that damage at low energies consists of vacancies and interstitials and that the regular arrangement of atoms on a lattice has an important influence on the character of damage events. The calculations have proved the feasibility of simulating events of radiation damage by mathematical models on high speed computers. (N.W.R.)

30897 (BNL-6333) THE INFLUENCE OF RADIATION-PRODUCED DEFECTS ON THE PRECIPITATION OF CARBON IN IRON. F. E. Fujita and A. C. Damask (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 14p.

The effect of enhanced nucleation was studied in the iron–carbon system. Measurements were made by electrical resistivity, internal friction, and electron microscopy. Two effects were found. When the alloy is irradiated at ambient temperature (~60°C) the number of precipitation particles formed and, hence, the rate of precipitation of carbon, is ten times the number in the unirradiated alloy. Further irradiation does not increase the number of precipitate particles. When the alloy is irradiated at low temperature (~ –100°C) the disappearance of carbon from solution is one thousand times faster than the thermal rate. It is deduced that the carbon is temporarily trapped by vacancies and later released to precipitate at a temperature higher than the precipitation temperature in the unirradiated alloy. (auth)

30898 (CRGM-1093) THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF WELDED ZIRCALOY-2. D. G. Evans (Atomic Energy of Canada Ltd., Chalk River, Ont.). July 1962. 51p. (AECL-1566)

Zircaloy-2 tensile specimens, subsize impact bars and representative spigot welds were subjected to three NRX cycles in the X-5 loop. Average loop temperature was 260°C over the three cycles. One group of tensile specimens was heat-treated in vacuum at 900°C for 40 minutes, another group contained welded areas in the center of the gauge length and a third group was hydrided after welding. Notches of the impact specimens were located in the fusion zone of the weld. Spigot welds were made on autoclaved and unautoclaved simulated production assemblies. Neutron irradiation had no effect on the impact properties of welded Zircaloy-2. Welding decreased the uniform and total elongation at room temperature and at 260°C, and increased the 260°C PL, YS, and UTS. Hydriding to a nominal 100 ppm hydrogen had no effect on the unirradiated tensile properties at either test temperature. The heat treatment decreased the strength properties but did not affect the ductility. Neutron irradiation increased the YS of the welded and hydrided material by 20% and the heat treated YS by 40%. Irradiation also increased the 260°C strength properties of the as-welded material. The unautoclaved spigot welds had a generally higher tensile strength than the autoclaved and welded specimens. For specimens welded in either condition, the outer welds of the 19-element bundle had a lower average breaking load than the inner welds. Neutron irradiation had no effect on the tensile strength of these welds. It was also demonstrated that a cup-and-cone type of fracture could be produced in a bend test. The fractures were similar to those observed in irradiated fuel bundles which was damaged during transfer operations. (auth)

30899 (D2-90044) ANALOG COMPUTER PREDICTION OF TRANSIENT NUCLEAR RADIATION EFFECTS. Glenn L. Keister (Boeing Airplane Co., Seattle). Oct. 11, 1961. Contract AF 33(616)-7804. 33p.

Using the results of electronic piece part tests, an analog computer was used to successfully predict the effect of transient nuclear radiation on circuits. The analog analysis of a typical is discussed utilizing empirical piece part data. The results are compared with the effects on an actual circuit in a pulsed radiation environment. (auth)

30900 (EURAEC-326) SWELLING OF URANIUM. Quarterly Report No. 6, January 1–March 31, 1962. (Brussels. Centre d'Étude de l'Énergie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 022-60-10 RDB I.2.5. 18p. (R-2120)

The practical application of a method for distinguishing vacancy from interstitial loops in irradiated materials was studied. The method is based on the one-sided nature of dislocation contrast for larger values of the interference error. The image side changes with the sign of the Burgers vector and hence with the character of the loops. The method was applied successfully to foils of platinum irradiated at liquid nitrogen temperature by means of α particles from boron nitride. The foils are packed in contact with boron nitride and irradiated by neutrons. After warming up to room temperature the foils are examined as-irradiated and also after annealing. After annealing for 1 hour at 500°C the loops are large enough to perform the contrast experiments. They are found to be due to vacancies. Thus one of the annealing stages of irradiated platinum can be identified unambiguously. The method will subsequently allow the determination of the character of the loops in irradiated uranium and hence the determination of any preferential precipitation of vacancies and interstitials on different planes, as probably happens during radiation growth. (auth)

30901 (GACD-3178) TRANSIENT RADIATION EFFECTS TECHNICAL SUMMARY REPORT COVERING THE PERIOD APRIL 15, 1961, THROUGH APRIL 14, 1962. D. M. J. Compton (General Atomic Div., General Dynamics Corp., San Diego, Calif.). May 15, 1962. Contract DA-49-186-502-ORD-939. 123p.

Progress made in the study of transient radiation effects on insulators, semiconductors, gases, metals, and electronic equipment is reported. The study reveals that the transient effects are due primarily to secondary electron emission in the materials. The mechanisms, theory, and experiments employed in the study are outlined and discussed. (N.W.R.)

30902 (HW-61923) PLASTICS FOR USE IN RADIATION FIELDS. I. EFFECT OF GAMMA RADIATION ON

THE PHYSICAL PROPERTIES OF PLASTICS. Robert Harrington (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 20, 1961. Contract AT (45-1)-1350. 24p.

Data are given on the effects of gamma radiation on the physical properties of plastics classified as polycarbonate, polyethylene, fluorocarbon, polyamide, polyester, reinforced, silicone, and vinyl. The irradiations were carried out in air at ambient temperature and normal atmospheric pressure to various doses up to 1×10^9 r depending upon the stability of the materials to radiation exposure. The different classes of materials and materials within a class are compared. Generally speaking, radiation damage had the greatest effect on the fluorocarbons and the least effect on the resinous reinforced materials. (P.C.H.)

30903 (HW-66977) ELASTOMERS FOR USE IN RADIATION FIELDS. XIV. EFFECT OF CARBON BLACK AND OTHER FILLERS ON A NITRILE ELASTOMER. Robert Harrington (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1, 1961. Contract [AT(45-1)-1350]. 20p.

The effect various carbon black and other fillers have on the radiation resistance of a nitrile (acrylonitrile-butadiene copolymer) elastomer is discussed and supported by data. All of the compounds were exposed to gamma radiation in air at 25°C and normal atmospheric pressure to doses ranging up to 5×10^8 r. Results show that both hardness and tensile strength are affected in varying degrees with respect to compounds within a filler series and compounds of different series compared on an equal loading basis. The elongation, on the other hand, was essentially the same based upon percent change. The only consistent behavior noted among the various nitrile compounds was the extreme rise in tensile strength after exposure of 3×10^8 r with accompanying loss of elongation and severe embrittlement. (N.W.R.)

30904 (HW-SA-2500) IRRADIATION EFFECTS IN URANIUM DIOXIDE SINGLE CRYSTALS. J. L. Bates, J. A. Christensen, and J. L. Daniel (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 14, 1962. Contract [AT(45-1)-1350]. 31p.

The effects of irradiation on single crystals of UO_2 to 1.44×10^{20} fissions/cc at less than 400°C on gas release, lattice parameter, microstructures, hardness, and melting point were measured. The thermal conductivity of a UO_2 single crystal as a function of temperature was also measured. (auth)

30905 (HW-SA-2538) DIFFRACTION EFFECTS FROM IRRADIATED ALUMINUM SINGLE CRYSTALS. H. E. Kissinger (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 31, 1962]. Contract AT-(45-1)-1350. 16p.

Diffraction experiments indicate a disordered layer is formed on the surface of irradiated aluminum single crystals having a high degree of crystal perfection. More imperfect crystals do not appear to form the surface layer. Radio-induced point defects moving toward the free surface are suggested as a possible cause of the disordered layer. The interior of the crystal retains its highly perfect state after irradiation, from which it may be concluded that stable defect configurations are not present. (auth)

30906 (HW-SA-2654) RADIATION DAMAGE IN CERAMIC NUCLEAR FUEL. W. E. Roake (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 16, 1962. Contract AT(45-1)-1350. 33p.

A review of eight papers on radiation damage in ceramic nuclear fuels is presented. Topics covered include: radiation effects in fissile oxides and carbides at low and high burnup levels, low-temperature irradiation behavior of cast uranium carbide, effects of irradiation of uranium–carbon alloys with composition near that of *UC*, irradiation behavior of uranium carbide, effects of high burnup on oxide ceramic fuels, irradiation alteration of uranium dioxide, irradiation of fuels envisaged for the Rapsodic Reactor, and irradiation experiments with fuel suspensions. Results are compared. (M.C.G.)

30907 (HW-SA-2673) IN-REACTOR CREEP MEASUREMENTS ON ZIRCALOY-2. L. J. Chockie, J. J. Holmes; and J. C. Tobin (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 15, 1962. Contract AT(45-1)-1350. 25p.

Creep tests are being made on Zircaloy-2 while the specimen is exposed to neutron irradiation in a reactor. The experimental apparatus is described as is its development. Test temperatures are maintained to within ±2 degrees in the capsules and the strain is measured with microinch sensitivity. The instantaneous creep rates appear to be less under neutron radiation. When irradiation ceases during reactor shutdowns, marked increases in rate are observed. The resulting strain after several reactor cycles is greater than that found in an unirradiated test. (auth)

30908 (NARF-62-10T) COMPRESSION-SET BEHAVIOR OF IRRADIATED ELASTOMERS. E. G. Fritz and P. M. Johnson (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Aug. 1962. Contract AF(657)-7201. 25p. (MR-N-296)

The effects of mixed-field reactor radiation and pure gamma rays on the compression-set behavior of three different types of elastomers (Viton A, Silicone LS-53, and Neoprene WRT) are analyzed. The available experimental data, extended over five logarithmic decades of dose, were found to be well describable by the empirical equation $S_D = S_0 + (S_m - S_0)/(1 + X)$, where S_D = percent compression set in air after absorption by the sample of dose D [ergs/gm(C)], S_0 = percent compression set in air of unirradiated sample, S_m = maximum compression set in air as $D \to \infty$, and $X = \exp\{A + B \log D + C (\log D)^2\}$, where A, B, C = material constants. The results of the analysis are discussed and compared with other works. (auth)

30909 (NP-12004) EFFECT OF NUCLEAR RADIATION ON MATERIALS AT CRYOGENIC TEMPERATURES. Quarterly Progress Report No. 6, October 1961-June 1962. (Lockheed Nuclear Products, Marietta, Ga.). Contract NASw-114. 107p. (ER-5848)

Research progress on the effects of radiation on materials at cryogenic temperatures is summarized. All tests for the size correlation program were completed. Loop cool-down times, the seal condition of test loops II and III, and the temperature distribution in a miniature test specimen were evaluated. Development work on the Schaevitz dynamometer, dynamometer remote calibration ring and back-up system, extensometer and its calibration rig, compressometer, hydraulic system actuator, and instrumentation console was continued. Alloys which were added to the screening program are described. The criteria for specimen design and the techniques for fabrication of the test specimens are outlined. Conclusions derived from the size correlation report are also listed. The status of the air lock bridge and cart, hot cave, beam port shield, refrigeration system, transfer system, and seal test rig at Plum Brook is described. Ten calorimeters and all of the fission chambers required for the program were assembled and checked for operation, and results are reported.

Descriptions and postulations of the possible loss of coolant accidents and beam port shield accidents are given. (M.C.G.)

30910 (TID-12047) INFLUENCE OF BORON ON PRE- AND POST IRRADIATION PROPERTIES OF TYPE 304 STAINLESS STEEL AND WELD METAL. N. Balai and L. C. Hymes (Argonne National Lab., Ill.). [June 14, 1960]. Contract [W-31-109-Eng-38]. 30p. (UAC-4669)

Experimental heats of 2 wt % natural boron modified Type 304 stainless steel incorporating scrap from a commercial heat of the alloy, which failed to convert to sheet product, established the necessity of maintaining minimum manganese and silicon contents. When chemical composition is controlled, boron containing Type 304 stainless steels can be converted to sheet products which are formable. Severe embrittlement of the base metals was found after a total integrated exposure of 20×10^{20} nvt (thermal). Losses of resistance to impact, in miniature specimens were: over 60% in stainless steel Type 304, and, over 90% in both the 1 and the 2 wt % boron stainless steels. A 1-hr 900°F tempering heat treatment restored resistance to impact in Type 304 stainless steel but not in the 1 and 2 wt % boron stainless compositions. Impairments of resistance to impact, attributed to contamination by boron, were found in the as-welded Type 308 stainless weld metal joining plates of boron-stainless steel Type 304. Weld metal resistance to impact was reduced by irradiation to a common value of three ft-lb for the four welded plate combinations. Resistance to impact in unirradiated weld metal was restored by both the 1-hr 900°F tempering and the 1-hr 1950°F solution annealing thermal heat treatments. The 1-hr 900°F tempering and 1-hr 1950°F solution annealing heat treatments were either ineffective or completely embrittled the irradiated welds. Elevated temperature thermal heat treatments revealed that the irradiated boron stainless steels swelled in one hour at temperatures above 1300°F. (auth)

30911 (TID-16560) INHOMOGENEITIES IN SEMICONDUCTORS EXPOSED TO FAST NEUTRONS. B. R. Gossick (Arizona State Univ., Tempe). July 1962. Contract AT(11-1)-715. 15p.

Permittivity and conductivity were determined for a semiconducting sol of spheroidal inhomogeneities, with the symmetry axes oriented at random, the sols being those which might be induced by fast neutron, such as p-type particles in n-type material, a dispersion of metallic precipitates, or ring dislocations. The presence of the localized inhomogeneities in a semiconductor would significantly alter its electrical properties. Both the displacement of majority carriers and minority carrier storage about the inhomogeneities would contribute to the permittivity. The potential barriers, which might accompany the inhomogeneities, would not only reduce the conductivity of majority carriers, but simultaneously increase the conductivity of minority carriers. (auth)

30912 (AEC-tr-5074) PROCESS OF FORMATION OF BUBBLES IN IRRADIATED URANIUM. Fumio Hashimoto. Translated from Nippon Genshiryoku Gakkaishi, 2: 518-22 (1960). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 1921.

30913 INVESTIGATING RADIATION EFFECTS ON ELECTRONIC DEVICES. A. L. Kaplan (General Electric Co., Schenectady, N. Y.). Aerospace Eng., 21: No. 7, 40-50(June 1962).

The transient and permanent effects of radiation dose-rates on electronic equipment are described. The General Electric Pulsed Reactor, which is designed as a tool for studying these effects, is described and compared with other pulsed reactors. (T.F.H.)

30914 THE EFFECT OF IONIZING RADIATION ON THE PENETRATION BY AIR AND HUMIDITY OF PACKAGING FOILS. T. Gruenewald and A. Berger. Fette, Seifen, Anstrichmittel, 63: 928-34(Oct. 1961).

The following packaging materials were exposed to total doses of 25 Megarad: macrolon (20μ), macrolon (50μ), hostaphane (12.5μ), high pressure polyethylene (50μ), low pressure polyethylene (20μ), Al + polyethylene (20/30μ), and hostaphan-aluminum-polyethylene (15, 20, 50μ). It was found that the last packaging material combination showed the highest resistance against ionizing radiation and remained free of odor after irradiation. But it is very expensive and opaque. If a transparent and also less expensive packaging material is preferred, the next best combination, namely, hostaphane + polyethylene, can be used, but it is necessary to prevent odor formation. (OID)

30915 THEORETICAL ASPECTS OF RADIATION DAMAGE AND BRITTLE FRACTURE IN STEEL PRESSURE VESSELS. A. H. Cottrell. Ing. Nucleare, 4: 131-41 (July-Aug. 1962). (In Italian)

The problem of the radiation embrittlement of structural steel and its relation to reactor pressure vessels is discussed. Clustered lattice defects produced by knock-on collisions from fast neutrons harden steel by a process analogous to precipitation hardening. It is shown that for the amount of hardening produced, the increase of the ductile-brittle transition temperature by irradiation is quite normal. Estimates of this increase are made, and it is shown how these may be used to estimate the minimum operating temperature to maintain a pressure vessel above the crack-propagation temperature. The possibility of operating below this temperature, by preventing the initiation of fracture, is discussed critically. Estimates are made of safe ranges of notch sizes and working stresses. It is concluded that safety from brittle failure becomes certain only at temperatures above the crack-propagation temperature. (auth)

30916 THE EFFECT OF THE RADIATIONS ENCOUNTERED BY MATERIALS IN SPACE. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Interplanet. Soc., 18: 377-81(May-June 1962).

Knowledge of the radiations in space, together with the understanding of the effects caused by the radiation from nuclear reactors, accelerators, etc., suggest that the changes in the materials of space vehicles are small. However, the outer shell of a space vehicle suffers the less penetrating radiations, such as slow-moving atoms, met in space. These are unlikely to damage the surface or erode it appreciably except within the earth's atmosphere. The impact of micrometeorites upon the vehicle causes more violent surface effects and may occasionally puncture the outer shell. (auth)

30917 X-RAY DIFFRACTION STUDIES OF IRRADIATED BERYLLIUM OXIDE. B. S. Hickman (Australian Atomic Energy Commission Research Establishment, Lucas Heights, Sydney), T. M. Sabine, and R. A. Coyle. J. Nuclear Materials, 6: 190-8(July 1962). (In English)

Lattice parameter changes which occur on neutron irradiation of hot pressed beryllium oxide to integrated fission neutron doses of 1×10^{19} nvt to 3.5×10^{20} nvt at 75–100°C and to doses of $1-1.5 \times 10^{20}$ nvt at 500–650°C are reported. It is shown that an anisotropic lattice expansion occurs, the expansion in the c direction being greater than

the expansion in the a direction. The lattice expansion at irradiation temperatures of 500–600°C is almost a factor of three smaller than for equivalent neutron doses at 75–100°C. The volume expansion calculated from x-ray data is shown to agree with the macroscopic volume expansion. At doses of 3.5×10^{20} nvt and above at temperatures of 75–100°C, crumbling and cracking of the specimens occurs because of the intergranular stresses caused by the anisotropic expansion. The disagreement between various workers as to the degree of the anisotropy is explained in terms of the effect on the lattice parameters of the intergranular stress in solid polycrystalline specimens. The annealing behavior of the lattice parameter changes is described and it is shown that temperatures of 1400–1500°C are required for complete recovery of the damage to occur. Line broadening effects are discussed in a qualitative manner and it is suggested that defect clusters are formed in the basal planes of the hexagonal beryllium oxide lattice. (auth)

30918 EFFECT OF IRRADIATION OF NEUTRONS ON THE URANIUM–IRON ALLOYS DILUTE IN IRON. J. Bloch (Centre d'Etudes Nucléaires, Saclay, France). J. Nuclear Materials, 6: 203-12(July 1962). (In French)

Uranium-iron alloys, dilute in iron, become badly distorted under irradiation to quite small burn-ups (0.1% of all uranium atoms). Micrographic examination revealed a very pronounced deformation of both the phases present, U_6Fe and α uranium. On x-ray diffraction patterns, the lines due to U_6Fe progressively disappeared under the influence of fission fragments. The disappearance was not associated with any change in lattice parameters. Each fission event produces an amorphous condition in a small volume which was found to be approximately 1×10^{-17} cm^3. (auth)

30919 DOSE DISTRIBUTION ALONG THE AXIS OF A FLAT β SOURCE. II. MULTICOMPONENT MEDIUM. V. E. Yakhontova, A. M. Kononenko, and V. A. Petrov (Leningrad Inst. of Medical Radiology). Radiobiologiya, 2: 166-9(1962). (In Russian)

A formula was previously developed for the calculation of the dose distribution at a point in a single medium along the axis of a β source, with the source in the form of a flat disc. The applicability of this formula was extended to fit the particular case when there is a number of different media between the source and the point at which the dose is measured. In making this application, the dispersion of the electrons at the boundaries was neglected and the calculations were developed primarily for media with low atomic numbers. Under these conditions, it is shown that the distance of travel in the various media is a simple function of the stopping power or density of each medium. On the basis of these considerations, the distance of travel of electrons in each medium, subject to a density correlation, are substituted into the original equation for solving the dose distribution of the multicomponent system. (TTT)

30920 DEFECT COMPLEXES AND LITHIUM PRECIPITATION IN GERMANIUM. R. D. Weltzin (Univ. of Minnesota, Minneapolis) and R. A. Swalin. Prepublication Copy. 25p.

The role of oxygen, gamma-ray bombardment, annealing temperature, and solute concentration in the nucleation of lithium precipitates in germanium was investigated. Analysis of the experimental data indicates that the primary nucleation site for lithium precipitation is an oxygen-vacancy defect pair. (In actuality since oxygen is normally interstitially dissolved, this defect is equivalent to a substitutional oxygen.) The evidence indicates that about 1% of the oxygen exists in this substitutional state. For the reaction O + V = O–V, it is determined that the binding enthalpy of the pair is −0.6 ev and the concentration of O–V defects is given by $[O-V] = 2.6 \times 10^4 [0] \exp(-1.4/kT)$. Lithium is also found to exist in the paired state with interstitial oxygen although these complexes apparently are not active as nucleating sites. At room temperature about 25% of the interstitial oxygen atoms are paired according to the reaction $Li^+ + O = Li^+O$. The heat of binding of the pair is calculated to be about −0.5 ev. The possible explanation as to why substitution oxygen and not interstitial oxygen is important in nucleation of lithium is presented. (auth)

30921 POLYETHYLENE BLENDS. (to W. R. Grace and Co.). British Patent 904,985. Sept. 5, 1962.

A method is given for preparing a high- or intermediate-density polyethylene with good clarity and flow properties for processing and shaping operations. The method comprises blending a major portion of a parent polymer consisting of an uncrosslinked polyethylene of density 0.94 to 0.97 with a minor portion of a crosslinked polyethylene at a temperature above the melting point of the parent polymer, preferably at 150 to 175°C. The crosslinked polyethylene may be produced by irradiation, and its amount preferably is 0.5 to 5 wt % of the parent polymer. (D.L.C.)

30922 PROCESS FOR MODIFYING POLYMERS AND PRODUCTS OBTAINED THEREBY. Roger Arnold Hines and Warren Froemming Busse (to E. I. du Pont de Nemours and Co.). British Patent 905,043. Sept. 5, 1962.

A process is given for increasing the efficiency of the crosslinking produced by ionizing radiation in crosslinkable polymers. The process comprises contacting the polymers with gaseous vinyl chloride monomer prior to irradiation. The polymers which may be treated in this way are those of a 1-olefin, natural rubber, and butadiene polymers. Several examples of the process are given in which polyethylene was used. (D.L.C.)

30923 IRRADIATION CROSS-LINKING OF COPOLYMERS. Wendell V. Smith (to U. S. Rubber Co.). U. S. Patent 3,053,742. Sept. 11, 1962.

Certain vinyl chloride copolymers can be crosslinked by small doses of ionizing radiation, in contrast to the behavior of polyvinyl chloride and its other copolymers. These copolymers include the high-molecular-weight resinous copolymers of vinyl chloride with 10 to 40% of the following monomers: dialkyl maleates and fumarates in which each alkyl group contains 4 or more C atoms, vinyl esters of fatty acids containing 3 or more C atoms, vinyl alkyl ethers in which the alkyl group contains 18 or more C atoms, alkyl acrylates, and alkyl methacrylates in which the alkyl group contains 3 or more C atoms. The inclusion of a reinforcing filler, e.g., carbon black or silica, renders the irradiated copolymer especially strong at high temperatures. (D.L.C.)

PHYSICS

General and Miscellaneous

30924 (CU(PNPL)-214) PROGRESS REPORT [ON NUCLEAR PHYSICS] FOR OCTOBER–DECEMBER 1961 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. (Columbia Univ., New York. Pegram Nuclear Physics Labs.). Contract AT-30-1-GEN-72. 36p.

The measurements of the mass distribution of fission fragments from thermal neutron fission of U^{235}, U^{233}, and Pu^{239} were completed. A paper is being prepared on the rotational motions in ammonium salts. Work associated with charged particle investigations is reported. Information is included on installation of a new Van de Graaff terminal, N^{15} reactions with He ions, (p,γ) experiments, energy variation of the cyclotron, and coulomb excitation research. Light particle investigations were conducted on energy dependent beta–gamma angular correlation in Rb^{86} and Rb^{84}, search for two quanta emission from 1.73-Mev 0^+ level of Zr^{90}, and fast lifetime measurements. Work on instrument development is reported. A transistorized single-channel pulse-height analyzer for 0.1 μsec double delay line clipped pulses was designed. A linear gating circuit was built for the (p,γ) inverse resonance experiments using the 36-in. cyclotron. The analyzer magnet current regulator designed for the model CN nanosecond pulsing unit in the Van de Graaff generator was installed. The firing control system of the Nevis synchrocyclotron was completed and installed. A precision delay generator was designed for the Nevis synchrocyclotron neutron velocity selector system, and a unit was constructed to permit adjustment of the phase relations in a rotary slit system of this machine. (J.R.D.)

30925 (LADC-5227) EXPERIMENTAL CESIUM LINE SHAPES. Lewis Agnew and C. Summers (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 21p.

In partially-ionized cesium plasmas above 10^{13} ions-cm^{-3}, the plasma-broadened lines are easily measured and can be used as a simple diagnostic method for the determination of ion density, once the width versus ion density relationship is established either theoretically or experimentally. Measured line widths are presented and results are compared with theoretical widths. The profiles of various lines of the sharp, diffuse, and fundamental series lines of cesium were measured at known ion densities with a scanning monochromator on a hot-cathode parallel-geometry cesium diode. For each case, the ion density and the electron temperature were determined by measuring the intensity of the radiative recombination continuum. Line intensities gave independent measurements of temperature that were in agreement with electron temperatures, showing the existence of local thermodynamic equilibrium and providing a confirmation of ion density through the application of the Saha equation. Detailed results of line width measurements are presented for a range of plasma density from 3.2×10^{13} to 1.6×10^{15} ions-cm^{-3} and at 2000 to 6000°K. (auth)

30926 (LADC-5230) EXPERIMENTAL STUDIES OF Cs–CsF–Mo AND Cs–CsF–W PLASMA DIODE EMITTERS. W. A. Ranken, R. L. Aamodt, L. J. Brown, and B. D. Nichols (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 22p.

Measurements are presented which demonstrate that the electron emission of molybdenum in cesium vapor is greatly enhanced by the addition of cesium fluoride. The enhancement amounts to a factor of about 340 at the maxima of the respective Langmuir S-curves for a cesium pressure of 10^{-2} mm Hg. The minimum effective work function of the Cs–CsF–Mo surface is 1.38 ± 0.05 ev. Preliminary measurements of the work function of cesium fluoride coated tungsten were made by obtaining retarding potential curves for photo electrons liberated from the cesium fluoride coated tube wall by an external light source. An activation process is indicated by the fact that it is necessary to heat the tungsten wire to about 1100°K in order to obtain a high work function surface. A Cs–CsF–W emitter was incorporated into a plasma cell of unguarded parallel plate design. At the initial emitter-collector spacing of 0.25 in. attempts to operate the cell in the low voltage arc regime met with little success, although some cross over into the useful power section of the current-voltage characteristic occurs for a cesium pressure of 0.1 mm Hg and emitter temperatures in the region about 1900°K. Arc currents extrapolated to zero voltage indicate that the emission of the Cs–CsF–W emitter is about the same as that from a Cs–CsF–Mo emitter. (auth)

30927 (LADC-5311) STRUCTURE AND STABILITY OF THE SQUARE-WAVE DETONATION. Jerome J. Erpenbeck (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 25p.

The structure of the square-wave limit of steady detonation is obtained through consideration of the limiting solution of a one-reaction detonation, having an Arrhenius rate constant, for large values of the activation energy. Asymptotic expressions for the solution through the induction, reaction, and equilibrium zones are derived. The stability of the limiting flow is considered through the general theory of detonation stability. It is found that the recent square-wave model calculation of Zaidel is invalid since the reactivity of the fluid in the induction zone is important to the propagation of disturbances of the frequency considered in Zaidel's analysis. The consequences of the consideration of disturbances of a frequency appropriate to the reaction-zone width are considered. (auth)

30928 (NP-11996) PARAMAGNETIC RESONANCE IN THE SOLID STATE. Progress Report No. 16, April–June 1962. Hartmut P. Kallmann (New York Univ., New York). July 1962. Contract DA 36-039 SC-78056. 10p.

The trapped electrons in silver and copper activated zinc sulfide phosphors should have an uncompensated spin, and therefore exhibit an EPR signal. When the phosphor is subjected to infrared and ultraviolet radiations and to variations in temperature, the behavior of this EPR signal should show a correlation to the phosphor model established on the basis of luminescence and conductivity experiments. An investigation was made of the phosphors' EPR signals. (auth)

30929 (NP-12003) ANNUAL REPORT, 1961. (European Organization for Nuclear Research, Geneva). 1962. 154p.

The activities of CERN in 1961 are reported. Topics covered include: history, organization, proton synchroton, synchro-cyclotron, nuclear physics, engineering, data handling, theoretical studies, track chambers, nuclear physics apparatus, accelerator research, site and buildings, health physics, finance, and administration. Lists

of publications, reprints, lectures, seminars, and colloquia are included. (M.C.G.)

30930 (NYO-2669) PROGRESS REPORT NO. 60 [ON NUCLEAR RESEARCH]. (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). May 1, 1962. Contracts AT(30-1)-905 and AT(30-1)-2098. 108p.

Activities in the group concerned with the chemistry of fission elements were devoted to investigation of the fundamental chemical behavior of certain elements, development of analytical methods, and a study of new instrumental chemical techniques. In the inorganic nuclear chemistry group, data were obtained on Ag-H_2 and Na-H_2 exchange with sulfonated resins and water. Other work is reported on solvent extraction of the Cs salts of several perfluorochloro-carboxylic acids, decay of Ag^{115}, delayed proton emission following the beta decay of Ti^{41}, decay of Sc^{42}, and computer programs development. Research is also reported on fission of Nb^{95}, decay of fission-product Sb nuclides, fission yields of Xe^{139} and Xe^{135}, and fission of U^{233} with deuterons and He ions. In the organic nuclear chemistry group, papers were prepared on O_2 equilibration of triphenylmethyl benzoate-carbonyl-O^{18} in acetone at 60°C, and on catalysis by secondary valence forces. Other work was concerned with a study of dimethyl (cis- or trans-4-t-butylcyclohexyl) carbinyl hypochlorite in CCl_4. A new method was developed for the preparation of diacyl peroxides under unusually mild conditions. Activities in the cosmic ray group were devoted to analysis of data from Explorer XI, study of cosmic-ray diurnal variation, theoretical analysis of nuclear interactions at extreme cosmic ray energies, study of radially expanding plasma in uniform magnetic fields, and study of the interaction of high energy pions in the cloud of a nucleon. The linear accelerator group conducted experiments in which measurements of the neutron energy spectra from photofission of U^{238} and Th^{232} were made. Measurements were also made on the energy resolution of the 2-in. dia gas counter for 5-Mev alpha particles. In the high energy accelerator group activities were concerned with synchrotron operation and photography of extensive air showers. Other work is reported on analysis of Λ° magnetic moments and angular distributions of π and κ scattering, photoproduction of π^- mesons from deuterium, proton polarization in deuteron photodisintegration, and the proton Compton effect. In the ONR generator group, study of the (d,p) reaction is reported on a number of gas and thin solid targets from B to Pb. Activities in the radioactivity group were directed to studies concerned with the magnetic moments of 5^- states in Sn^{113} and Sn^{120}, decay of Tl^{199} and Au^{199}, frequency shift of 14.4-kev photons on traversing radiation fields, and the optical rotation of quartz for 14.4-kev gamma rays. Work in the cyclotron group is reported on (α,α') and (p,p') experiments on medium weight nuclei, and statistical alpha particle-induced emission. Noteworthy developments in the theoretical group include application of the boundary condition potential model to pion and nucleon-nucleon interactions, formulation and application of a surface reaction theory, and application of field theoretical methods to reaction problems. (J.R.D.)

30931 (ORNL-3260) ENERGY REMOVED FROM PRIMARY PROTON AND NEUTRON BEAMS BY TISSUE. W. A. Gibson (Oak Ridge National Lab., Tenn.). Sept. 20, 1962. Contract W-7405-eng-26. 16p.

The energy removed from primary nucleon beams with energies between 10 and 1000 Mev as they pass through biological tissue is calculated. It is shown that for neutrons with energies above 15 Mev and for protons above 300 Mev the major energy removal mechanism is nuclear absorption of the primary nucleon and that the importance of this process increases with increasing nucleon energy. A qualitative discussion is also given of the biological importance of the secondary nucleons and of the nuclear recoils resulting from the absorption process. (auth)

30932 (TID-11961) SUGANO'S THEOREM. Gordon L. Goodman (Argonne National Lab., Ill.). Jan. 1961. Contract [W-31-109-eng-38]. 4p. (UAC-4866)

An erroneous statement in Sugano's theorem is pointed out and discussed as to its effect on the conclusion of the theorem. Satoru Sugano's theorem gives an understanding of rotational strengths for those optical transitions that can be treated in terms of ligand-field theory. The theorem is as follows: rotational strengths that in zero-order vanish according to Laport's rule are modified in first-order by the mixing of single-electron orbitals that differ only in parity, all other zero-order transformation properties being the same for them. The erroneous statement in the theorem's proof is "the Wigner coefficient $(\Gamma\gamma|\Gamma\gamma\Gamma^*\gamma^*)$ is (not in general), irrespective of $\Gamma\gamma$ and γ^*, zero for the case of interest here, $\Gamma^* = T_1, T_2$." (N.W.R.)

30933 (UCRL-9404) THE COMPLETE BOUND SPECTRUM OF THE NEGATIVE HYDROGEN ION. Charles Schwartz (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 1960. Contract W-7405-eng-48. 3p.

The calculation of the lower bounds for the eigenvalue E_i of the hamiltonian $H = H_0 + V$ were carried out for the negative hydrogen ion, $V = e^2/r_{12}$. The calculations were for the lowest state (in H_0) of each kind, but the order of levels with a given set of good quantum numbers must remain unchanged in going from H_0 to H. It is proved that there are no bound states of H^- other than the one well known ^1S. (P.C.H.)

30934 TWO-PHOTON TRANSITIONS BETWEEN HYPERFINE-STRUCTURE LEVELS OF THE 1S STATE OF THE HYDROGEN ATOM. V. P. Demidov. Astron. Zhur., 5: 816-18(May-June 1962). (In English)

The probabilities of two-photon transitions between hyperfine-structure levels of the ground state of the hydrogen atom in the presence and absence of an external field are computed. These are found to be extremely small; therefore two-photon processes cannot have any influence on radio-astronomical measurements on a wave length of 21 cm. (auth)

30935 AURORA AND AIRGLOW. Joseph W. Chamberlain (Univ. of Chicago). Astronautics, 7: No. 8, 66-8(Aug. 1962).

The use of measurements on aurorae and day, night, and twilight airglows, as a means for studying the atmosphere, the geomagnetic fields, the trapped-radiation belts, and the mechanisms of the aurorae and airglows themselves, is discussed. Features of the auroral spectra are outlined, and the auroral and day, night, and twilight airglow emission intensities are compared. (T.F.H.)

30936 STATUS OF SUPERCONDUCTIVITY. William H. Jones, Frederick J. Milford, and Sherwood L. Fawcett. Battelle Tech. Rev., 11: No. 9, 2-11(Sept. 1962).

Major discoveries that made possible the breakthroughs in superconductivity are reviewed, and the implications of recent developments for various areas of technology and their possible applications are discussed. Relation of the superconductive state to magnetic fields, thermodynamic properties of superconductivity, theory of the superconductive state, experimental and theoretical research, and the current status of materials development and device development are presented. (P.C.H.)

30937 ON THE BACKSCATTERING OF ELECTRONS FROM SOLIDS. Z. T. Boedy (Ball-Bearing Works, Debrecen, Hungary). Brit. J. Appl. Phys., 13: 483-5(Sept. 1962).

It is shown that it is hardly possible to obtain Everhart's backscattering coefficient as a function of Z by considering only large angle single scatterings and fitting parametrically to experimental points, because backscattering receives large contributions from two-fold (and probably many-fold) collisions even at small atomic numbers. It is therefore suggested that in attempts to improve backscattering calculations a diffusion theory must have an advantage over single and many-fold scattering theories. (auth)

30938 EFFECT OF FREON-12 ON THE THERMAL IONIZATION OF URANIUM ON TUNGSTEN. K. F. Zmbov. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13, No. 2, 17-28(July 1962). (In English)

The temperature dependence of ion current intensities of U^+, UO^+, and UO_2^+ obtained on a tungsten surface in a vacuum ($P \approx 10^{-6}$ mm Hg) was investigated by means of a mass spectrometer. The same was done with U^+, UF^+, and UF_3^+ ions in the presence of freon-12 ($P = 10^{-5}$ mm Hg). The characteristics observed were explained by means of both ionization and dissociation processes. At temperatures exceeding 2200°K uranium was ionized according to the Saha-Langmuir equation. The ionization potential was determined as $V_{U^+} = 6.1 \pm 0.1$ ev. An increase in the work function of 0.7 ± 0.1 ev was observed in the presence of freon. (auth)

30939 THE INTERACTION OF FOILS ACTIVATED BY THERMAL NEUTRONS. D. Babala and M. Voříšek (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Řež). Czechoslov. J. Phys., 12: 523-29(1962). (In English)

The interaction of foils lying in a plane during their activation by thermal neutrons is calculated. Numerical values of functions that can be used in calculations are listed, especially for graphite. The interaction is measured in a graphite column of a reactor. (auth)

30940 SOME PECULIARITIES OF VAVILOV-ČERENKOV RADIATION IN BIAXIAL CRYSTALS. Č. Muzikář (Charles Univ., Prague). Czechoslov. J. Phys., 12: 561-2 (1962). (In English)

The spectral density of the Vavilov-Cherenkov radiation emitted by charged particles moving in the direction of the biradial of a biaxial crystal is calculated. The particles are assumed to move with a velocity (β) near the critical velocity for Cherenkov radiation (β_c). The dependence of the spectral density on β has a sharp edge at $\beta = \beta_c$. The wave vectors of the Cherenkov radiation at $\beta = \beta_c$ form a cone that is identical with the cone of conical refraction. As β becomes larger than β_c, however, this initial cone decomposes into two cones. These properties of the Cherenkov wave vectors and spectral density are concluded to be peculiar to biaxial crystals. (T.F.H.)

30941 PRODUCTION OF A BEAM OF HYDROGEN ATOMS IN THE EXCITED METASTABLE STATE 2S. PART I. G. Bassani (Università, Milan), L. Colli, F. Cristofori, M. O. Franceschetti, G. E. Frigerio, and P. G. Sona. Energia nucleare (Milan), 9: 451-4(Aug. 1962). (In English)

The production of a beam of hydrogen atoms excited in the metastable level 2S, by means of a charge exchange mechanism, was studied. A beam of protons of some kev passing through a chamber containing a gas at the pressure ranging from 10^{-3} to 10^{-2} mm Hg was used. The absolute number of the produced metastable atoms, and the ratio between this number and the total number of hydrogen atoms in any state were measured for different gases, varying the pressure. (auth)

30942 EFFECT OF PRESSURE ON THE RESISTANCE OF FUSED-RING AROMATIC COMPOUNDS. G. A. Samara and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys., 37: 474-9(Aug. 1, 1962).

The effect of pressure to several hundred kilobars was measured on the resistance of seven-fused ring aromatic compounds, including two polyacenes and five quinones. In general, there is a rapid drop in resistance at lower pressures, followed by a marked leveling at above 200 to 250 kbars. The leveling is apparently associated with the rapid decrease in compressibility at high pressure observed by Bridgman. The resistance at high pressure varied by several orders of magnitude among the compounds. It seems to be closely associated with the amount of overlap between adjacent molecules in the unit cell. The temperature coefficient of resistance at high pressure was obtained for three compounds. They all remained semiconductors at the highest pressure studied, but the activation energy was about one-sixth of the atmospheric pressure value. (auth)

30943 INTENSITIES OF CRYSTAL SPECTRA OF RARE-EARTH IONS. G. S. Ofelt (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 37: 511-20(Aug. 1, 1962).

Magnetic and electric dipole transitions between levels of the $4f^x$ configuration perturbed by a static crystalline field are treated. The expression obtained for the pure-electronic electric-dipole transition probability involves matrix elements of an even-order unit tensor between the two $4f^x$ states involved in the transition. The contributions to the transition probability from interactions, via the crystalline field, with the $nd^9 4f^{x-1}$, $4f^{x-1}nd$, $4f^{x-1}ng$ configurations are shown to add linearly, in such a manner as to multiply each odd k crystal-field parameter A_k^q by a constant. If "J mixing" in the $4f^x$ configuration is neglected ΔJ between the upper and lower $4f^x$ levels is restricted to six units or less. If "L mixing" is neglected then ΔL is also restricted to six units or less. Application is made to the fluorescence spectra of $PrCl_3$ and $EuCl_3$. Many of the missing and weak transitions are explained. (auth)

30944 MAGNETIC SUSCEPTIBILITY OF NEPTUNIUM HEXAFLUORIDE IN URANIUM HEXAFLUORIDE. Clyde A. Hutchison, Jr., Tung Tsang, and Bernard Weinstock (Univ. of Chicago and Argonne National Lab., Ill.). J. Chem. Phys., 37: 555-62(Aug. 1, 1962).

The magnetic susceptibilities of solid solutions of NpF_6 in UF_6 were measured by the Faraday method. Measurements were made on solutions with mole fractions 0.0000, 0.0407, 0.0972, 0.1806, 0.340, 0.646, and 1.000 NpF_6 and over the temperature range from the boiling point of liquid He to 336.9°K. The susceptibilities χ of Np^{+6} so determined were fitted by equations of the form

$$\chi = \chi_0 + g_s^2 N\beta^2/4kT = \chi_0 + 0.09380\, g_s^2/T \qquad (a)$$

at the lower concentrations of NpF_6, and by

$$\chi = \chi_0 + g_s^2 N\beta^2/4kT + A/T^2 \qquad (b)$$

at the higher concentrations of NpF_6. The values of $|g_s|$ and χ_0 extrapolated to infinite dilution are 0.605 and 165×10^{-6} cm^3 $mole^{-1}$, respectively, using unrationalized Maxwell equations. The standard deviations of these values are 0.004 and 20×10^{-6}, respectively. There is no observable variation of χ_0 with concentration of NpF_6 in UF_6. $|g_s|$ is observed to increase from the value 0.641 for pure NpF_6 and to pass through a maximum value 0.694 for the 0.340 mole fraction sample as the concentration of NpF_6 is decreased. The susceptibilities of solutions of 0.646 mole

fraction NpF_6 in UF_6 above the melting point are lower by about 10 times the error of the determination than those given by (b) when (b) is fitted to only those measurements made below the melting point. They are lower by approximately 4%. The value of the susceptibility of pure UF_6 is found to be $43.7 \pm 2.6 \times 10^{-6}$ cm^3 mole^{-1} independent of temperature. The value of the susceptibility of fused silica is found to be $-0.412 \pm 0.005 \times 10^{-6}$ cm^3 g^{-1} and is independent of temperature. The measurements for NpF_6 are compared with the results of the studies of paramagnetic resonance of NpF_6 and with theoretical discussions of the electronic states of this molecule. (auth)

30945 IONIZATION AND EXCITATION PROCESSES IN ARGON, KRYPTON, AND THE C_2 HYDROCARBONS PRODUCED BY VARIOUS MEANS. Charles E. Melton (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 37: 562-6 (Aug. 1, 1962).

Multiple ionization produced in argon and krypton by 3.5-kev electrons is reported. The ionization mechanism is tentatively proposed to be similar to that known for nuclear transitions, namely, a combination of electron shakeoff with primary ionization in one of the inner-orbital-electron shells (n = 1 or 2) followed by Auger transitions. The relative proportions of fragment ions produced in the C_2 hydrocarbons by 3.5-kev electrons are also reported. These data bear a marked similarity to those obtained by the dissociative ionization of the C_2 hydrocarbons with 75-ev electrons. However, ions produced by 3.5-kev electrons retain excitation energy longer as is shown by their respective rates of intramolecular decomposition (metastable transitions). Despite the longer retention of excitation energy, the reaction rate for 3.5-kev electron-induced ions in ion–molecule reactions is the same as that for 75-ev electron-induced ions. Reaction rates between neutral molecules and $C_2H_4^+$ ions from different parent molecules appear to be independent of the parent, thus suggesting that the ions, initially probably different in configuration, all rearrange to the same configuration before reacting. The fragment ion pattern produced in ethane by 50 to 75-ev electrons is strikingly similar to that produced by either 3.5-kev electrons or by 5-Mev α particles. In ethylene, likewise, the fragment ion patterns produced by 5-Mev α particles, β particles from Ni^{63}, 3.5-kev electrons and 50 to 75-ev electrons are quite similar. This lends some support to the common practice of using 50 to 75-ev mass spectra to predict primary ion products in radiation chemistry. (auth)

30946 QUANTUM TREATMENT OF THE PHYSICAL ADSORPTION OF ISOTOPIC SPECIES. Robert Yaris and John R. Sams, Jr. (Univ. of Washington, Seattle). J. Chem. Phys., 37: 571-6(Aug. 1, 1962).

The results of isotopic substitution in the adsorption of H_2, D_2, CH_4, and CD_4 on a graphitized carbon black observed by Constabaris, Sams, and Halsey are explained in terms of two competing effects: the quantum statistical mass effect on the vibrational energy levels normal to the surface and the quantum mechanical effect of isotopic substitution on the dispersion energy. (auth)

30947 ELECTRIC RESONANCE SPECTRUM AND DIPOLE MOMENT OF BaO. L. Wharton, M. Kaufman, and W. Klemperer (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 37: 621-6(Aug. 1, 1962).

The dipole moment of BaO in several vibrational states was determined to be $\mu_0 = 7.955$ D, $\mu_1 = 0.997$ D, $\mu_2 = 8.039$ D, $\mu_3 = 8.079$ D with an error of ±0.003 D by the molecular-beam electric-resonance technique. The change of the dipole moment of BaO with vibrational state agrees with the change predicted by the Rittner model of classically polarizable ions. Measurement of relative intensities of vibrational lines yields a value of 680 ± 100 cm^{-1} for the vibrational frequency of the molecule and fourth-order Stark effect yields a value of 0.304 ± 0.007 cm^{-1} for the rotation constant, in agreement with the more accurate spectroscopic determinations. The Ramsey method of separated oscillatory electric fields was used successfully in electric resonance, with the expected narrowing of linewidth. Because BaO is composed of spinless nuclei, it is proposed as the basis of a voltage or electric field standard that could have a precision of 1 part in 10^8. A table of fourth-order Stark coefficients is appended. (auth)

30948 DETECTION OF H_3^+ IN THE HYDROGEN GLOW DISCHARGE. P. H. Dawson and A. W. Tickner (National Research Council, Ottawa). J. Chem. Phys., 37: 672-3 (Aug. 1, 1962).

In experiments with a negative glow, ions having m/e = 4 and 5 were detected in addition to ions having m/e = 1, 2, and 3. The ion of m/e = 4 can be accounted for as H_2D^+, while the ion of m/e = 5 is apparently H_3^+ since its counterpart in a D_2 discharge has a m/e = 10. The ions H_5O^+ and H_3O^+ were also observed in the interior of the negative glow. (D.L.C.)

30949 ELECTRICAL CONDUCTANCE OF SOLUTIONS OF SALTS IN LIQUID METALS. II. POTASSIUM FLUORIDE AND BROMIDE IN POTASSIUM. H. R. Bronstein, A. S. Dworkin, and M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 37: 677-8(Aug. 1, 1962).

The specific conductivity of liquid K decreases rapidly with the dissolution of KI and KF at 700°C and of KBr at 740°C. The resistivity of the metal-rich solutions is found to increase linearly with increasing salt concentration, following the equation $\rho = aN + b$, where N = mole fraction of the metal. The parameter b (resistivity of pure K) is 60.5 $\mu\Omega$-cm at 700°C and 64 $\mu\Omega$-cm at 740°C, and the slope a is 3.90, 6.85, and 9.05 $\mu\Omega$-cm for KF, KBr, and KI, respectively. It is concluded that the resistivity of the liquid metal is a linear function of the concentration of the electron-scattering centers introduced by the salt and of the square of the anion radius. (D.L.C.)

30950 REACTION OF NITROGEN AND HYDROGEN IN A LOW-TEMPERATURE PLASMA. Gene G. Mannella (Battelle Memorial Inst., Columbus, Ohio). J. Chem. Phys., 37: 678-9(Aug. 1, 1962).

The reaction of N_2 and H_2 in an argon plasma was studied spectroscopically. The spectrograms for equimolar H_2–N_2 mixtures showed the N_2 first positive system but not the second positive system. The (0,0) band of the $NH(A^3\pi\text{-}X^3\Sigma^-)$ transition at 3360 to 3370 A was very strong, while the (0,0) and (1,0) bands of the $NH(c^1\pi\text{-}a^1\Delta)$ interaction were present to a lesser degree. A spectral feature at ~4500 A was tentatively identified as the (0,0) band of the $NH(c^1\pi\text{-}b^1\Sigma^+)$ system. No evidence was found for metastable N atoms or N_2^+ ions. It is concluded that $N(^4S)$ and $H(^2S)$ probably recombine to form $NH(X^3\Sigma^-)$, which is then excited by other reactants, possibly in this way: $N_2(A^3\Sigma_u^+) + NH(X^3\Sigma^-) \rightarrow N_2(X^1\Sigma_g^+) + NH(c^1\pi)$. The formation of $NH(A^3\pi)$ is also considered. (D.L.C.)

30951 QUADRUPOLE AND INDUCED DIPOLE SPECTRUM OF MOLECULAR HYDROGEN. D. H. Rank, B. S. Rao, P. Sitaram, A. F. Slomba, and T. A. Wiggins (Pennsylvania State Univ., University Park). J. Opt. Soc. Am., 52: 1004-9(Sept. 1962).

The fundamental band of the quadrupole spectrum of hydrogen was observed. The frequencies of the Q(1), S(0), S(1), S(2), and S(3) lines were all measured employing a maximum path of 1.4-km atm. The lines are of essentially

Doppler width even at pressures as high as 10 atm. Using the ground state constants determined by Stoicheff from Raman measurements, the molecular constants for the v = 1 state were determined and compared with the constants for higher vibrational states. The ratio of the intensity of the S(0) line to the intensity of the R(0) line of the HCl fundamental band was determined. This ratio is compared with the theoretical prediction of James and Coolidge. In addition new theoretical ratios were determined based on higher-order approximations of Kolos and Roothaan. These new calculations indicate that the 1–0, 2–0, and 3–0 bands should have relative intensities of 1 : 0.20 : 0.028, a result probably in agreement with the experimental observations and the photographic infrared work of Herzberg. The induced dipole spectrum also was observed. The absorption coefficients obtained agree with the results observed in the high-pressure experiments of Welsh and his co-workers. The Q_P, Q_R splitting is apparent even at only a few atmospheres pressure producing a relatively sharp (2 cm^{-1} wide) transmission band centered on the position of Q(1). (auth)

30952 INFRARED TRANSMITTANCE AND REFLECTANCE OF BERYLLIUM OXIDE. J. R. Durig, R. C. Lord (Massachusetts Inst. of Tech., Cambridge), W. J. Gardner, and L. H. Johnston. J. Opt. Soc. Am., 52: 1078(Sept. 1962).

The infrared transmittance of BeO single crystals and pressed plates was measured at 50 to 4000 cm^{-1}. The main absorption band fell in the neighborhood of 500 to 1000 cm^{-1}, with three small bands on the high frequency side. The infrared reflectance of BeO pressed disk was measured at 450 to 1200 cm^{-1}; the main reststrahlen frequency was found to be 730 ± 10^{-1} with a subsidiary maximum at 1050 cm^{-1}. (D.L.C.)

30953 DIRECT OBSERVATION OF RISE OF FLUORESCENCE IN Tb^{3+} FOLLOWING A SHORT BURST OF ULTRAVIOLET EXCITATION. G. E. Peterson and P. M. Bridenbaugh (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Opt. Soc. Am., 52: 1079–80(Sept. 1962).

The rise of fluorescence of the $^5D_4 \rightarrow {}^7F_5$ transition of Tb^{3+} in $KLa_{0.98}Tb_{0.02}W_2O_8$ was observed after a 5-μsec burst of uv at 3200 to 3800 A. The green light from the transition was followed for 950 μsec after the excitation; it was found to rise to a maximum in ~250 μsec and then decay exponentially. The intensity may be written as $I = A \exp(-R_1 t) - B \exp(-R_2 t)$, where $1/R_1 = T_1 = 634$ μsec and $1/R_2 = T_2 = 251$ μsec. R_2 increases with high temperatures and Tb^{3+} concentrations. (D.L.C.)

30954 MAGNETOCRYSTALLINE ANISOTROPY OF GADOLINIUM. C. D. Graham, Jr. (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1310(Aug. 1962). (In English)

Torque measurements on single crystals of Gd (hexagonal structure) are made at 10 to 350°K and at magnetic fields up to 20 kOe, and Fourier analysis of the measured torque curves is used to determine the anisotropy constants. (T.F.H.)

30955 THE DURATION OF PHOTO- AND RADIOLUMINESCENCE OF ORGANIC COMPOUNDS. S. F. Kilin. Optics and Spectroscopy, 12: 414-16(June 1962).

The duration of the photo- and radioluminescence of plastic scintillators, organic crystals, and powders is measured by a phase method. Measurement of the depth of modulation of the luminescent light output shows that there is a slow component in the quenching of radioluminescence in organic powder luminors. This slow component can produce as much as a third of the total light output. (auth)

30956 EXCITATION OF THE 2s AND 2p LEVELS OF THE HYDROGEN ATOM BY ELECTRON IMPACT. R. Ya. Damburg. Optics and Spectroscopy, 12: 445-6(June 1962).

Electron-atomic H collisions are analyzed, taking account of all terms coupling the three levels 1s, 2s, and 2p, and neglecting exchange effects. For a given L, the problem is resolved into the solution of a set of three (L = 0) or four (L ≥ 1) associated differential equations, which are solved numerically. The cross sections obtained are compared with experimental data. (T.F.H.)

30957 LIFETIME OF A QUASI-PARTICLE IN A SUPERCONDUCTOR AT FINITE TEMPERATURES AND APPLICATION TO THE PROBLEM OF THERMAL CONDUCTIVITY. Ludwig Tewordt (Univ. of Notre Dame, Ind.). Phys. Rev., 128: 12-20(Oct. 1, 1962).

The theory of the lifetime of a quasi-particle at finite temperatures is developed by using a generalization of the Green's function formalism of Nambu. The explicit results for the lifetime, as a function of the excitation energy and the temperature, are applied to the problem of electronic thermal conductivity when interaction with the phonons is the limiting mechanism for the heat flux. The lifetime appears in a general expression for the thermal conductivity which is derived from the corresponding Boltzmann equation by making a relaxation-time approximation. The resulting curve for the ratio of the thermal conductivity in the superconducting state to that in the normal state versus the reduced temperature is found to decrease monotonically and to have a slope of about 2 at the transition temperature. (auth)

30958 EXCHANGE FIELD SPLITTING IN YTTERBIUM IRON GARNET. H. Watanabe and B. N. Brockhouse (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev., 128: 67(Oct. 1, 1962).

The exchange-field splitting of a single Yb^{3+} ion in ytterbium iron garnet was measured by observing the energy distribution of neutrons scattered by the specimen at room temperature and at liquid nitrogen temperature. The results are consistent with those of other experiments and also with Tinkham's spin-wave model. (auth)

30959 ELECTRON SPIN RESONANCE OF A CENTER IN CALCIUM FLUOROPHOSPHATE. B. Segall, G. W. Ludwig, H. H. Woodbury, and P. D. Johnson (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev., 128: 76-9(Oct. 1, 1962).

A spin-resonance center whose concentration is sensitive to x irradiation has been observed in synthetic calcium fluorophosphate crystals. It shows an electron spin of ½ and hyperfine interaction with two equivalent F^{19} nuclei. Arguments are presented which lead to its identification as an O^- ion occupying an F^- site. (auth)

30960 ENERGY BANDS OF ALKALI METALS. I. CALCULATED BANDS. Frank S. Ham (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev., 128: 82-97(Oct. 1, 1962).

The results of energy band calculations for all of the alkali metals Li, Na, K, Rb, and Cs, obtained using the quantum defect method and the Green's function method, are reported for points of low symmetry within the Brillouin zone as well as for the usual points of high symmetry. Definite trends in the band structure are revealed through the alkali metal series and as a function of lattice constant. The Fermi surfaces of Li and Cs are the most distorted by bulges in the [110] directions, while those of Na and K are nearly spherical; the corresponding gaps ($N_I - N_F$) at equilibrium at 0°K are (in rydbergs): Li, +0.209; Na, +0.018; K, −0.037; Rb, −0.063;

Cs, −0.088. Except for Na the gaps and distortion increase significantly in magnitude with decreasing lattice constant. However the Fermi surface of Li is found not to contact the zone face even under substantial pressure, while contact occurs for Cs at a slight compression. Excited bands are also given; there is a pronounced trend for d states to fall increasingly lower relative to s, p, and f states in the sequence Li to Cs, and for p states to rise in this sequence relative to s and f states. Detailed comparisons are given with calculations by Callaway, Brooks, Schlosser, Allen, and others. These comparisons support the view that the significant features of these band structures are not very sensitive to uncertainties in the crystal potential. (auth)

30961 EFFECT OF ENERGETIC SECONDARY ELECTRONS ON THE SCINTILLATION PROCESS IN ALKALI HALIDE CRYSTALS. Axel Meyer and R. B. Murray (Oak Ridge National Lab., Tenn.). Phys. Rev., 128: 98-105 (Oct. 1, 1962).

Experimental results have previously shown that the scintillation efficiency of alkali halide crystals to heavy particles is not a function of dE/dx alone but is instead composed of a series of discrete functions, one for each incident particle. This paper presents an analysis of these experimental results with attention to the effect of energetic secondary electrons (delta rays) produced by the primary particle. In this treatment the total light emitted per unit path length of the incident particle is the sum of two contributions: one from the highly ionized primary column, and one from these delta rays which escape the primary column and produce light with a high efficiency. (auth)

30962 SURFACE EFFECTS IN THE SECOND-ORDER DOPPLER SHIFT OF THE MÖSSBAUER RESONANCE. R. F. Wallis (U. S. Naval Research Lab., Washington, D. C.) and D. C. Gazis. Phys. Rev., 128: 106-10(Oct. 1, 1962).

The second-order Doppler shift in the Mössbauer effect depends upon the mean-square velocities of the emitting and absorbing atoms. On the basis of a theorem discussed by Born in connection with the lattice dynamical theory of the Debye-Waller factor, a general expression has been obtained for the mean-square velocity of an arbitrary atom in a crystal lattice, assuming harmonic forces. The result is valid for any temperature and may be applied to lattices having free surfaces or impurities. Approximate expressions are developed for the high- and low-temperature limits. The general results are applied to specific calculations of the mean-square velocity for atoms at or near a free surface. Ordinarily, the mean-square velocity turns out to be smaller for an atom at the surface than for one in the interior of the crystal. This is a consequence of the surface atom being linked to fewer neighboring atoms than is the case for an interior atom. It is concluded, however, that whether or not a crystal lattice possesses surface modes of vibration has little direct bearing on the mean-square velocity of surface atoms. (auth)

30963 THERMAL CONDUCTIVITY OF A SYSTEM OF INTERACTING ELECTRONS. J. S. Langer (Univ. of California, San Diego, La Jolla). Phys. Rev., 128: 110-17(Oct. 1, 1962).

Kubo's formula for thermal conductivity is evaluated for the case of an interacting electron gas and random, fixed, impurities. As in previous work, the theorems proved are exact to all orders in the electron-electron interactions and to lowest order in the concentration of impurities. The heat flux is examined in some detail and a Ward's identity is derived for the associated vertex function. Although the heat flux contains contributions from the interaction energy of pairs (or larger clusters) of correlated quasi-particles, it is found that these contributions enter the thermal conductivity only to higher orders in the impurity concentration. In a normal system where the many-body correlations are sufficiently weak, the Wiedemann-Franz law remains valid. (auth)

30964 FERMI SURFACE OF BERYLLIUM BY POSITRON ANNIHILATION. A. T. Stewart, J. B. Shand, J. J. Donaghy, and J. H. Kusmiss (Univ. of North Carolina, Chapel Hill). Phys. Rev., 128: 118-19(Oct. 1, 1962).

Measurements have been made of the angular correlation of photons from positron annihilation in single crystals of beryllium. The data yield areas of cross sections of the Fermi sea. The observed distributions of areas show an anisotropy which in in reasonable agreement with qualitative ideas of the Fermi surface of beryllium. Some evidence is seen of the higher momentum components of Bloch wave functions for electrons near a Brillouin zone boundary. (auth)

30965 GROUND-STATE ENERGY OF METALLIC HYDROGEN. [PART] I. W. J. Carr, Jr. (Westinghouse Electric Corp., Pittsburgh). Phys. Rev., 128: 120-5 (Oct. 1, 1962).

The ground-state energy of metallic hydrogen is calculated within the framework of a perturbation expansion by interpreting the perturbation series as that for two simpler systems weakly interacting, one being the electron gas system, the other that of electrons moving in the periodic potential of the lattice neutralized by a uniformly distributed negative charge. The decomposition is conveniently obtained by dividing the Rayleigh-Schrödinger perturbation expansion into three parts, the first two parts representing essentially the energy of the two simpler problems while the third part gives a series expansion for the small interaction terms. The first nonvanishing term in the latter comes from third order in the Rayleigh-Schrödinger series and has the small value 0.001 r_s Ry per electron, where r_s is the radius of the unit sphere in atomic units. The interaction between the two systems is therefore assumed to have this order of magnitude. The Fermi surface which leads to minimum energy of the total system in the high-density limit has been expressed in terms of anisotropy constants. The deviation from a spherical surface contributes no terms to the energy larger than order r_s^2, with a coefficient of order 10^{-5} Ry. The ground-state energy for the N electrons then is given by $E = V_L + E_{eg}(0) + [E_p(0) - \epsilon_0 - \{V_p\}] + 0.001Nr_s + O(r_s^2, r_s^2 \ln r_s)$, where V_L is the energy of a lattice of positive charges in a uniform background negative charge, $E_{eg}(0)$ is the gound-state energy of the electron gas, $E_p(0)$ is the energy of the periodic potential problem for a spherical Fermi surface, ϵ_0 is the Fermi energy of free electrons, and (V_p) is the average value of the periodic potential. The uncertainty introduced by neglecting the $O(r_s^2)$ and higher order terms in the above equation is estimated, from the previous considerations, to be of order 10^{-3} Nr, ry. The energy $E_p(0)$ may be calculated by conventional band methods or by means of many-body perturbation theory. The latter gives an expansion $E_p(0) = N(2.21/r_s^2 - 0.613/r_s - 0.0905 - 0.018r_s + \cdots)$ in powers of r_s, for a body-centered-cubic lattice. An estimate of the next or r_s^2 term is $-0.005r_s^2$. The use of this expansion for $E_p(0)$ and of previous estimates for $E_{eg}(0)$ gives a result for the energy of metallic hydrogen

very close to the previous calculations of Wigner and Huntington. (auth)

30966 THEORY OF SUPERCONDUCTIVITY. II. PROPERTIES OF THE MODIFIED ELECTRON-LATTICE STATES OF LOW ENERGY. R. K. Nesbet (Boston Univ.). Phys. Rev., 128: 139-50(Oct. 1, 1962).

In addition to causing electron-phonon scattering, the electron-lattice interaction, considered in a previous paper, also modifies the structure of the stationary states, which become mixtures of the states considered in the adiabatic or Born-Oppenheimer approximation. The modified phonon and electron energies and electric current density are calculated. When a criterion depending on band structure is satisfied, the modified electronic configuration of lowest energy can be qualitatively different from the Fermi distribution of a normal metal, due to an effective interaction between electrons and holes of the same spin on each energy shell that arises from the electron-lattice interaction. Below a critical temperature there are two independent states of stationary free energy. The upper state has normal conductivity and heat capacity. The lower state has associated with it an electric current density that appears to have no dissipative resistance and that exhibits a Meissner effect with a resonance phenomenon at certain frequencies in an oscillatory field. In zero field the phase transition between these states is of second order, with a discontinuity in heat capacity at the transition temperature. An energy gap can occur, but it is not required in deriving the properties of the electric current density and of the phase transition between the two states. Various quantities calculated from the present theory for a simple model (effective mass, spherical Fermi surface, single conduction band) are in reasonable agreement with experimental values. Energies are generally an order of magnitude smaller than in the earlier theory of Fröhlich. (auth)

30967 PARAMAGNETIC RESONANCE OF Mo^{5+} IN TiO_2. Ru-tao Kyi (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 128: 151-3(Oct. 1, 1962).

The paramagnetic resonance spectrum of molybdenum in rutile (TiO_2) has been studied. The crystal contained 0.05 molar percent molybdenum ions, and the experiments were mainly carried out at 77°K. The observed resonance lines were identified as due to molybdenum in a +5 valence state. The g values in the directions of the three orthorhombic crystal field axes are −1.7883, -1.8117, and −1.9125. The effective orbital g factor, k, was calculated to be 0.8784, indicating partial covalent bonding. Hyperfine lines from Mo^{95} and Mo^{97} were also observed, and their hyperfine interaction constants were calculated. The resonance lines broadened at helium temperature due to saturation of the sample. The spin-lattice relaxation time is very long at this temperature. It increased from 10 to 600 sec as the temperature decreased from 4.2 to 1.3°K. (auth)

30968 CROSS SECTIONS AND ELECTRON AFFINITY FOR O^- IONS FROM O_2, CO, AND CO_2 BY ELECTRON IMPACT. G. J. Schulz (Westinghouse Electric Corp., Pittsburgh). Phys. Rev., 128: 178-86(Oct. 1, 1962).

Cross sections for the formation of O^- from O_2, CO, and CO_2 have been measured using an electron beam experiment in which an attempt is made to eliminate kinetic energy and angular discrimination by collecting most of the positive and negative ions produced in the tube. The cross sections are independent of electron current, pressure, and magnetic field. The values of these cross sections at their peak are 1.3×10^{-18} cm^2 at 6.7 ev in O_2, 1.6×10^{-19} cm^2 at 10.1 ev in CO, and 4.5×10^{-19} cm^2 at 8.2 ev in CO_2. O^- from CO_2 exhibits a second smaller peak at 4.2 ev with a cross section of 1.5×10^{-19} cm^2. Kinetic-energy measurements on the O^- ion from O_2 and CO_2 are not compatible with the value for the electron affinity(1.465 ev) obtained from photodetachment experiments but yield an electron affinity of 2.0 ± 0.1 ev and so suggest the existence of excited states of O^-. The experimental evidence from triatomic molecules N_2O, NO_2, and SO_2 is reviewed and is consistent with the higher value for the electron affinity for oxygen. (auth)

30969 NUCLEAR MAGNETIC RESONANCE IN GASEOUS He^3. K. Luszczynski, R. E. Norberg, and J. E. Opfer (Washington Univ., St. Louis). Phys. Rev., 128: 186-91(Oct. 1, 1962).

Relative nuclear magnetic susceptibility, self-diffusion coefficient D, and spin lattice relaxation time T_1 (characteristic of wall relaxation) were measured in He^3 gas between 1.7 and 4.2°K in the range of pressure between 0.08 and 56 atm. These results were derived from measurements of free induction decays and spin echoes at 20.00 Mc/sec. Values for the density of the gas were deduced on the assumption that the gas obeys Curie's law. At moderate densities D was found to be inversely proportional to the density, while T_1 was found to increase with the density of the gas. Experimental results obtained for the self-diffusion coefficient are compared with theoretical values. Details of experimental procedure are described. (auth)

30970 HYPERFINE STRUCTURE OF ATOMIC PHOSPHORUS. R. H. Lambert and F. M. Pipkin (Harvard Univ., Cambridge, Mass.). Phys. Rev., 128: 198-201 (Oct. 1, 1962).

The spin-exchange optical polarization method was used to determine the sign and the magnitude of the hyperfine interaction constant in the ground $(3p)^3\ ^4S_{3/2}$ state of atomic P^{31}. The measurements were made by monitoring the transmission of circularly polarized rubidium D_1 ($5P_{1/2} \rightarrow 5S_{1/2}$) resonance radiation through a flask containing rubidium, atomic phosphorus, and a buffer gas as a function of the frequency of an external radio-frequency field. The value for the hyperfine interaction constant of P^{31} obtained by extrapolation to zero pressure in a helium buffer gas is $A(P^{31}) = +(55\ 055\ 691 \pm 8)$ cps/sec. The pressure shifts in cycles/sec/mm Hg of the phosphorus hyperfine interaction constant for helium and neon buffer gases are +3.61 ± 0.23 and +6.73 ± 0.15, respectively. (auth)

30971 CONSTRUCTING THE SPIN HAMILTONIAN FOR AN N-ELECTRON SYSTEM. J. S. Faulkner (Univ. of Florida, Gainesville). Phys. Rev., 128: 202-5(Oct. 1, 1962).

The problem of constructing an effective spin Hamiltonian that will have the same eigenvalues as a physical system of N electrons is considered. It is assumed that the eigenvalues are obtained by some other means and the exchange integrals are treated as parameters to be adjusted so as to fit them. It is found that there definite restrictions on carrying out this scheme with a vector model Hamiltonian, although it can always be done with a spin Hamiltonian containing higher order products of spin functions. These restrictions should be kept in mind when using perturbation theory or some other method to improve the definition of exchange integrals. (auth)

30972 CROSS SECTIONS FOR THE DE-EXCITATION OF HELIUM METASTABLE ATOMS BY COLLISIONS WITH ATOMS. E. E. Benton, E. E. Ferguson, F. A.

Matsen, and W. W. Robertson (Univ. of Texas, Austin). Phys. Rev., 128: 206-9(Oct. 1, 1962).

The lifetimes of metastable helium atoms He(2 ^{3}S) and He(2 ^{1}S) were measured by a time-resolved optical absorption technique in the afterglow of a pulsed helium discharge at 10-mm pressure with small concentrations of various impurity gases added. The following de-excitation cross sections in units of 10^{-16} cm^2 have been determined for He(2 ^{3}S): Ne–0.28, Ar–6.6, Kr–10.3, Xe–13.9, N_2–6.4, and H_2–6.0. The uncertainties are estimated to be ±20% for the rare gases and ±50% for the molecular gases. He(2 ^{1}S) cross sections were measured to be N–4.1, Ar–55, Kr–64, and Xe–103, all times 10^{-16} cm^2. The neon cross section is believed reliable to ±20% but the remaining singlet cross sections may be too high by as much as a factor 2 or 3. The cross sections refer to de-excitation by ionizing collisions except in the case of neon where neon excitation occurs. Competing destruction processes render the singlet cross-section analysis somewhat uncertain except in the case of neon. (auth)

30973 CALCULATION OF CROSS SECTIONS FOR ZERO ACTIVATION ENERGY PROCESSES BY SIMPLE COLLISION MODELS WITH EMPHASIS ON THE PENNING EFFECT. Eldon E. Ferguson (Univ. of Texas, Austin). Phys. Rev., 128: 210-12(Oct. 1, 1962).

Recent cross sections obtained for the destruction of He(2 ^{3}S) metastable atoms by ionization of Ar, Kr, Xe, H_2, and N_2 are analyzed by a simple collision picture. It is found that the ratio of the experimental to momentum transfer cross sections is the same order as the efficiency of ejection of electrons from metal surfaces by He(2 ^{3}S) atoms, namely 0.2–0.3. The momentum transfer cross sections agree with the experimental values better than some of the published experimental values agree among themselves and in addition there is a great paucity of data in this area so that an order-of-magnitude estimate is often useful. In addition, it is shown that calculated momentum transfer cross sections for the reactions,

$$\mathrm{He}(2\,^3\mathrm{S}) + \mathrm{He}(2\,^3\mathrm{S}) \rightarrow \mathrm{He}^+ + \mathrm{He}(1\,^1\mathrm{S}) + e^-,$$
$$\mathrm{He}_2^+ + \mathrm{Ne} \rightarrow \mathrm{Ne}^+ + 2\,\mathrm{He}$$
$$\mathrm{He}(1\,^1\mathrm{S}) + \mathrm{He}(n\,^1\mathrm{P}) \rightarrow \mathrm{He}(1\,^1\mathrm{S}) + \mathrm{He}(nf),$$
$$\mathrm{He}(2\,^1\mathrm{S}) + \mathrm{Ar} \rightarrow \mathrm{He}(1\,^1\mathrm{S}) + \mathrm{Ar}^+ + e^-,$$

agree very well with literature values of cross sections for the processes. It appears that for a broad class of atomic reactions requiring zero activation energy, a momentum transfer collision has a high probability of reaction. Momentum transfer cross sections are dominated by the long-range attractive forces and can easily be calculated, thereby providing a useful estimate of the actual reaction cross section. (auth)

30974 CALCULATION OF THE HYPERFINE CONSTANTS FOR B^{11} AND O^{17}. N. Bessis, H. Lefebvre-Brion, and C. M. Moser (Centre de Mecanique Ondulatoire Appliquee, Paris). Phys. Rev., 128: 213-18(Oct. 1, 1962).

The hyperfine constants for B^{11} and O^{17} have been calculated using a configuration interaction (CI) function based on the usual Hartree-Fock (HF) representation (where the orbitals are expressed as linear combinations of analytic functions) plus singly excited $s \rightarrow s'$ functions and, for oxygen, singly excited $p \rightarrow p'$ functions. The s functions are made up of two second-degree polynomials, each multiplied by a different exponential function. The p functions are linear combinations of several 2p analytic orbitals. The energies were minimized with respect to the exponents of s functions. The values obtained are (experimental results are given in parentheses): for the ^{2}P state of B^{11}, $a_{\frac{1}{2}} = 67$ Mc/sec (73.3 Mc/sec); $a_{\frac{3}{2}} = 360.5$ Mc/sec (366.5 Mc/sec); Q = 0.039 b (deduced from $b_{\frac{3}{2}} = 2.695$ Mc/sec); for the ^{3}P state of O^{17}: $a_{\frac{3}{2}} = -216$ Mc/sec (–218.57 Mc/sec) $a'_{\frac{3}{2}} = -132$ Mc/sec (–126.6 Mc/sec), $a_1 = 3.8$ Mc/sec (4.74 Mc/sec), $a'_1 = -113$ Mc/sec (–91.8 Mc/sec, Q = –0.024 b (deduced from $b_{\frac{3}{2}} = -10.4$ Mc/sec). For oxygen, the CI calculation where each excited $p \rightarrow p'$ configuration is represented by three independent functions is shown to be an approximation to the most general formulation of what Löwdin has called the extended Hartree-Fock (eHF) functions. The unrestricted Hartree-Fock (UHF) functions have also been calculated. As the UHF functions are not eigenfunctions of J^2, there is no unambiguous way to define functions for states corresponding to definite values of J. For both boron and oxygen the values of the Fermi contact term obtained from projection of the UHF functions are in better agreement with experiment than the values calculated from the UHF functions. (auth)

30975 NUCLEAR PHYSICS IN WARSAW. Zdzisław Wilhelmi. Postepy Fizyki, 13: 237-52(1962). (In Polish)

A history of Nuclear Physics in Warsaw is given beginning with the first cascade ion accelerator built in the pre-war period at the University of Warsaw and including the creation of the Institute of Nuclear Research (IBJ) in 1955. The accumulation of nuclear physics equipment such as accelerators, reactors, fast and slow neutron choppers, multichannel analyzers, etc., is presented in chronological order. The types of activities of the various divisions of IBJ are covered. These include nuclear transmutations, stripping and pickup reactions, polarization of neutrons, beta and gamma spectras-copy including work with short-lived isotopes, weak interactions, and plasma physics. Some of the theoretical programs are mentioned. Contacts with laboratories in other countries are discussed. Also, the personnel makeup of some of the IBJ divisions is given (i.e., division 1A is composed of about 100 people: 35% physicists, 17% engineering specialists, 44% technicians and laboratory attendants, and only 4% administrative personnel). A large list of publications of the Warsaw group is given, dating back to 1950. (TTT)

30976 RECOILLESS NUCLEAR RESONANCE ABSORPTION OF GAMMA RADIATION. Rudolf L. Moessbauer (California Inst. of Tech., Pasadena). Science, 137: 731-8 (Sept. 7, 1962).

Developments leading to the discovery of the Moessbauer effect are reviewed. Fundamental aspects of the effect are noted. (T.F.H.)

30977 IODINE-129: ITS OCCURRENCE IN NATURE AND ITS UTILITY AS A TRACER. R. R. Edwards (Nuclear Science and Engineering Corp., Pittsburgh). Science, 137: 851-3(Sept. 14, 1962).

Natural production rates of the 16 million-year I^{129} from spontaneous fission and cosmic-ray reactions are estimated to contribute a steady-state concentration of more than 10^{-14} gram of I^{129} per gram of I^{127} to the hydrosphere, atmosphere, and biosphere. The concentrations are expected to be detectable by neutron-activation analysis in natural materials that concentrate iodine. Substantial additional contributions were made by fission-produced I^{129} in fallout, serving as an intrinsic tracer for natural iodine kinetics. I^{129} activation analysis has advantages as a tracer technique. (auth)

30978 MEASUREMENT OF THE RECOMBINATION RATE OF EXCESS CHARGE CARRIERS IN GERMANIUM

BY MODULATION OF THE IMPURITY PHOTOCONDUCTIVITY. K. D. Glinchuk, N. M. Litovchenko, and E. G. Miselyuk. Ukrain. Fiz. Zhur., 7: 387-95(Apr. 1962). (In Ukrainian)

The method for measuring the recombination rate by modulation of the impurity photoconductivity is described. It is shown that this method can be used for the determination, at different temperatures, of the cross sections for capture of majority carriers by impurities with deep levels. (auth)

30979 ON THE PROBE CHARACTERISTICS OF X-RAY AND PHOTOELECTRIC CURRENTS IN SINGLE CRYSTALS OF THE CdS TYPE. S. V. Svechnikov, V. G. Chalaya, and M. K. Sheinkman. Ukrain. Fiz. Zhur., 7: 396-402(Apr. 1962). (In Ukrainian)

The dependence of the photoelectric current on the position of the photo-beam probe between the electrodes, during excitation of CdS, CdSe, and CdS_x-CdSe_{1-x} crystals by a narrow light or x-ray probe is studied. Agreement of these dependences is found for visible and x radiation (with the photoelectric currents having equal values in the maximum). The maximum may occur during radiation of the cathode, anode, and middle part of the specimen. The data permit estimations to be made of the role of excitation energy migration in the crystal. Inferences are drawn as to the possible mechanism of this migration. (auth)

30980 EFFECT OF REGIONS OF INAPPLICABILITY OF GEOMETRICAL OPTICS ON WAVE SCATTERING OCCURRING AT FLUCTUATIONS OF THE DIELECTRIC CONSTANT. F. G. Bass. Ukrain. Fiz. Zhur., 7: 409-16(Apr. 1962). (In Ukrainian)

It is shown that when a wave falls on the ionospheric layer, the presence of points of inapplicability of geometrical optics—turning points and reflecting points—greatly increases the intensity of radiation scattered by the fluctuations of dielectric permeability in the direction of reflection of the average field. This effect is caused both by the reflection of the scattered field and by the scattering of the reflected wave. (auth)

30981 VAPOUR PRESSURE AND THE EVAPORATION COEFFICIENT OF NICKEL. G. P. Kovtun, A. A. Kruglykh, and V. S. Pavlov. Ukrain. Fiz. Zhur., 7: 436-8(Apr. 1961). (In Ukrainian)

The vapor pressure of nickel is determined from 1190 to 1355°C by the method of evaporation from a cylindrical crucible. The results are expressed by the equation $\lg p = 10.562 - 22360/T$ (p in mmHg, T in °K). The value for the coefficient of evaporation is close to unity. (auth)

30982 RESONANCE SCATTERING OF GAMMA-RAYS BY IMPURITY NUCLEI LOCATED IN A SOLID. I. P. Dzyub, A. F. Lubchenko, and Yun-wen Tsin. Ukrain. Fiz. Zhur., 7: 457-69(May 1962). (In Ukrainian)

The excitation and scattering spectra of gamma rays are calculated with allowance made for the change in the frequencies of normal-mode oscillations and the equilibrium positions of impurity atoms with gamma transitions, making two assumptions: the spectrum of the incident gamma rays (within the width of the phonon part of the excitation or scattering spectrum) is constant; and the energy of the gamma rays is much greater than the width of the phonon part of the spectrum. It is shown that in the case of considerable heat production and dispersion of the frequencies of normal oscillations of a solid, the excitation spectrum has the form of a quasi-gaussian curve with an intense line of natural width (Mössbauer line) on its long-wave side; and in the case of low heat production the spectrum is the sum of the Lorentz curves of natural width. The spectrum of scattered gamma rays does not coincide in form with the radiation spectrum, except in the case when the observation is conducted at an angle of $\pi/2$. In the case of great heat production and dispersion the spectrum has the form of a quasi-gaussian curve with a Mössbauer line on the short-wave side, while in the case of low heat production it constitutes the sum of the Lorentz curves. The positions of the excitation and the scattering spectra (including the Mössbauer lines) depend on the temperature. The spectrum of scattered "soft" gamma rays is also calculated for the case when the spectrum of the incident gamma rays has the form of a Lorentz curve. It is shown that the width of the Mössbauer line in the scattering spectrum is less than the natural width if the spectrum of the incident gamma rays has a natural width and its maximum coincides with that of the Mössbauer line. (auth)

30983 EMISSIVITY OF DIFFUSED JUNCTION. Y. A. Tkhorik. Ukrain. Fiz. Zhur., 7: 476-82(May 1962). (In Ukrainian)

The coefficient of injection is not a constant of the junction but depends on the structure of the junction, the properties of the contact of the metal with the strong doped region of the semiconductor, and the current intensity. The parameter β is derived, uniting all these properties. The value of β (the "emissivity of the junction") is calculated for the diffused junction, and criteria for a high emissivity are deduced. It is shown that with given contact properties, boundary concentration, thickness of the transitional region, and recombination coefficient, the emissivity of the diffused junction is not less than that in the case of linear distribution of the impurity. (auth)

30984 ABSORPTION AND LUMINESCENCE IMPURITIES IN CRYSTALS OF ORGANIC COMPOUNDS AT 20°K. VI. EFFECT OF THE CRYSTALLINE SOLVENT ON THE FREQUENCY OF ELECTRON-TRANSITIONAL IMPURITIES. A. V. Solovyov. Ukrain. Fiz. Zhur., 7: 492-504(May 1962). (In Ukrainian)

The theory defining the change in the frequency of electron transitions in impurity spectra as a function of the properties of the solvent and impurity molecules is subjected to experimental checking. The basic relationship of the theory is modified: a correction coefficient is introduced allowing for the fact that molecules are not points and that not all atoms of the solvent molecules interact with the impurity atoms to the same degree: the application of the derived formula is extended to the cases when the solvent molecules have constant dipole moments; the polarizability of the molecules in the crystals is calculated by the average value of the refraction index of the crystal. The application of the modified relationship yields satisfactory values for all calculated magnitudes. (auth)

30985 ABSORPTION AND LUMINESCENCE IMPURITIES IN CRYSTALS OF ORGANIC COMPOUNDS AT 20°K. VII. EFFECT OF THE VARIABLE COMPOSITION OF MIXED CRYSTALS ON THE FREQUENCY OF ELECTRON-TRANSITIONAL IMPURITIES. A. V. Solovyov. Ukrain. Fiz. Zhur., 7: 505-11(May 1962). (In Ukrainian)

The mechanisms for the displacement of the electron transition in impurity spectra of naphthacene in a mixed dibenzyl-stibene crystal, upon varying the concentration of the components of this crystal, are studied. Some necessary data are taken from roentgenostructural investigations of the dibenzyl-stilbene system, and others from calculations based on the spectral data on naphtha-

cene impurities in separate dibenzyl and stilbene crystals. Agreement is obtained between the calculated and the experimental values. An attempt is made to explain the complex structure of the impurity spectra in organic crystals. (auth)

30986 THEORY OF THE FOCUSING OF THE ION-BEAMS BY MAGNETIC SECTOR WITH FRINGING FIELD. M. Popovici and V. R. Saulit. Vestnik Leningrad. Univ., No. 10, Ser. Fiz. i Khim., No. 2, 38-65(1962). (In Russian)

The theory of charged particle focusing by a homogeneous magnetic field whose sharply defined boundaries are straight lines is presented. The influence of the fringing field on the focusing is taken into consideration. (auth)

30987 ON THE MAGNETIC SURFACES OF A PERIODIC MAGNETIC FIELD WITH LARGE AXIAL FIELD CALCULATED WITH THE ACCURACY OF THE 4TH ORDER. N. M. Zueva, A. I. Morosov, and L. S. Solovev. Zhur. Tekh. Fis., 32: 897-9(July 1962). (In Russian)

The averaged equations for periodic magnetic field power lines, considering terms of the order $H_{\perp}/H_{||}$, possess one-dimension integrals. (tr-auth)

30988 THEORY OF ION FLOW DYNAMICS. Demetrios G. Samaras. Prentice-Hall Space Technology Series. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962. 649p. $15.00.

Investigations are made of the microscopic and macroscopic physics of ion flows; transport properties of these flows; similarity conditions and the theory of non-dimensional analysis of ionic flows; flow discontinuities, such as magnetic shock waves, magnetic detonation waves, and boundary layers; and wave propagation, oscillations, and resonance phenomena in ionic flows. Several types of steady and unsteady one- and two-dimensional flows are analyzed. The electrodynamic and relativistic theory required for understanding of the flow studies is outlined. (T.F.H.)

Astrophysics and Cosmology

30989 (NASA-TN-D-1465) THE EARLY CHRONOLOGY OF THE SOLAR SYSTEM. A. G. W. Cameron (National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York). Aug. 1962. 11p.

Discussion is given on how anomalies, applied to a study of meteorites, give information about the solar system's early history. In stone meteorites, xenon is sometimes enriched in Xe^{129}, and in iron meteorites, silver is sometimes enriched in Ag^{107}. If these anomalies are attributed to the decay of the extinct radioactivities of I^{129} and Pd^{107}, then it is possible to deduce the approximate time intervals between the cessation of nucleosynthesis in the interstellar gas and the formation and cooling of the meteorite parent bodies to the point where further fractionation of the elements involved ceases. The time interval is about 1.5×10^8 years for the xenon anomaly and about 2 to 4×10^7 years for the silver anomaly. (P.C.H.)

30990 INTERNAL STRUCTURE OF HYPERON CONFIGURATIONS OF STELLAR MASSES. V. A. Ambartsumyan and G. S. Saakyan (Byurakan Astrophysical Observatory, Academy of Sciences, USSR). Astron. Zhur., 5: 779-84(May-June 1962). (In English)

The internal structure of equilibrium configurations of stellar masses possessing a density of the order of that of the atomic nucleus and higher is studied. It is shown that the space metric inside the configurations deviates markedly from the Euclidean metric. In addition, the total number of baryons in several configurations is calculated. For large values of the total number of baryons, there are two solutions with different total energies. Of these, the configurations considered to be wholly stable are those associated with a larger mass defect. (auth)

30991 SOLAR RADIATION. Herbert Friedman (Naval Research Lab., Washington, D. C.). Astronautics, 7: No. 8, 14-23(Aug. 1962).

The electromagnetic spectra of the sun are analyzed. Effects of solar activity on these spectra are evaluated. The structure of different regions of the sun (photosphere, chromosphere, etc.) is discussed. Ground, satellite, and rocket measurements are considered. (T.F.H.)

30992 PROTECTION AGAINST THE SOLAR FLARE. Hermann J. Schaefer (Naval School of Aviation Medicine, Pensacola, Fla.). Astronautics, 7: No. 8, 24-5(Aug. 1962).

On the basis of a model that is assumed to give the typical time variation of the proton flux and spectrum from a large solar flare, calculations are carried out of the dose accumulation and total dose to a human in a space vehicle. It is found that little or no additional shielding is required for a vehicle whose size is on the order of that of the Apollo vehicle, assuming only one flare per mission. (T.F.H.)

30993 MAGNETIC FIELDS IN SPACE. Charles P. Sonett (NASA Office of Space Sciences, Washington, D. C.). Astronautics, 7: No. 8, 34-9(Aug. 1962).

The measurement of properties of the geomagnetic field and of the magnetic fields in earth's magnetosphere and in interplanetary space is discussed. Probe and satellite data are outlined, with particular reference to magnetometer measurements. (T.F.H.)

30994 SELF-INTERACTION OF LONGITUDINAL PLASMA OSCILLATIONS WITH GENERATION OF ELECTROMAGNETIC RADIATION. APPLICATION TO THE NARROW-BAND RADIO BURSTS OF THE SUN. R. W. Larenz (Technische Universitat, Hanover). Prepublication Copy. 17p.

In a review over the longitudinal and transversal r-f waves linearily coupled, it is pointed first to the difficulty of separating the transversal part to get radiation out of the plasma, and secondly to the lack of a substantial source of radiation, because these waves are representing free plasma wave modes. It is shown that nonlinear interaction of space charge waves yields a radiation source of pure transversal waves, which at the second harmonic of the plasma frequency can run through the plasma and leave it. Formulas of the radiation field at large distances from the source are given and applicated to the narrow band solar bursts. The observed exhibition of the second harmonic as well as the spectral energy distribution can easily be explained. (auth)

Cosmic Radiation

30995 (NYO-10240) THE INFLUENCE OF IONIZATION LOSS ON THE SHAPE OF THE DIFFERENTIAL PRIMARY COSMIC RAY ENERGY SPECTRUM. M. V. K. Appa Rao and M. F. Kaplon (Rochester, N. Y. Univ.). July 30, 1962. Contract AT(30-1)-875. 30p.

The effect of ionization loss on a primary cosmic ray spectrum of the form $N_{A,Z}(\epsilon) = [K(A,Z)\gamma/_{\epsilon}\gamma + 1]$ is calculated for H^1, Be^9, C^{12}, F^{19}, Al^{27}, Ca^{40}, and Fe^{56} as representative of the charge spectrum of primary cosmic rays. The calculation is carried out for passage through 2, 4, 6, and 10 gm/cm^2 of hydrogen and also for a model in which the amount of material traversed is inversely proportional to the momentum. The observable effects obtained, the shift of the maximum toward higher velocity with in-

creasing Z and the relative enrichment of the lighter nuclei/energy interval at low energies, are compared with the experimental data obtainable. Some discussion of the implications for aspects of the origin of cosmic rays is given. (auth)

30996 COSMIC RAYS AND THE INTERPLANETARY MEDIUM. Thomas Gold (Cornell Univ., Ithaca, N. Y.). Astronautics, 7: No. 8, 43-5(Aug. 1962).

A general outline is presented of the mechanisms for propagation of cosmic-ray and magnetic-field disturbances through the interplanetary space following solar flares. The effects of the magnetic-field disturbances on the intensity of galactic cosmic radiation are discussed. (T.F.H.)

30997 SOLAR AND TERRESTRIAL RELATIONSHIPS OF DAILY VARIATION OF COSMIC RAYS DURING THE I. G. Y. R. P. Kane (Physical Research Lab., Ahmedabad). Indian J. Phys., 36: 237-81(May 1962).

Solar and geomagnetic relationship of the daily variation of cosmic ray nucleonic component observed at Climax, Lincoln, Gottingen, Yakutask, Huancayo, Makerere, and Lae were studied with particular attention to possible distortion effects due to isotropic changes observed worldwide in the mean level of cosmic ray intensity and also to the actual scatter of values in individual groups. No significant relationship is indicated for several solar and geomagnetic criteria except for a slight association with geomagnetic storms. Comparison of amplitudes of the first harmonic at various stations shows that on many days, amplitudes are large, moderate, or low simultaneously at all stations and the hours of maxima are mostly in the afternoon. On many other days, amplitudes are high only at one or two stations, indicating short lived anisotropies, though instrumental troubles are also indicated to some extent. The second harmonic is smaller than the first harmonic for high latitudes; but at low latitudes the two are comparable. Many other details are discussed. (auth)

30998 COSMIC RAY THRESHOLD RIGIDITIES DURING THE MAGNETIC STORM OF NOVEMBER 12, 1960. C. J. Hatton and P. L. Marsden (Univ. of Leeds, Eng.). Phil. Mag. (8), 7: 1145-56(July 1962).

The intensity variations of the nucleonic component of cosmic radiation during the magnetic storm on November 12, 1960, are analyzed and it is shown that superimposed upon a world-wide reduction of threshold rigidities there were also anisotropic effects, persisting for several hours, which particularly influenced particles arriving over Europe. It is suggested that this was due to the pulling out of the geomagnetic field lines on the night side of the earth by solar plasma. (auth)

Criticality Studies

30999 (JAERI-1034) CRITICAL EXPERIMENTS AND ANALYSIS OF HOMOGENEOUS HEAVY WATER SYSTEM. 20 PERCENT ENRICHED U–D_2O REFLECTOR. (Japan Atomic Energy Research Inst., Tokyo). Apr. 1962. 55p. (In Japanese)

An aqueous homogeneous critical facility was constructed. A series of critical experiments was performed on the system in which heavy water reflector surrounded heavy water solutions of uranyl sulfate with a U^{235} enrichment of 20%. Heavy water molecule to U^{235} atom ratio in the solutions ranged from 3600 to 800 depending on the core diameter. Space dependencies of thermal neutron spectra in these systems were studied by the integral method with Lu. Deviations of epithermal neutron spectra from 1/E distribution were also investigated by the cadmium ratio method with In, Au, Pd, and Co. In theoretical analysis of these systems, leakage of fast neutrons from the core and competition of the leakage with resonance absorption in the core are important factors. Therefore the resonance escape probability was defined rigorously and a multigroup model was applied. The group constants were determined by averaging over spectra which were calculated by the Greuling Goertzel approximation. Agreements between theoretical and experimental results are satisfactory except perturbation terms. Discrepancies in the effective multiplication factors do not exceed 1%. Spatial distributions of the thermal, in-resonance, and fast neutron fluxes are well reproduced by the present theory. An agreement of the theoretical cadmium ratios in the core with the experimental values indicates that the leakage of fast neutrons from the core is treated adequately. (auth)

31000 (TID-6759) [PREDICTION OF SHAPE OF CRITICAL RADIATION BURSTS FROM GODIVA]. H. C. Paxton (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-36]. 38p. (LADC-3878)

A series of IBM-701 calculations aimed at predicting the shape of prompt critical radiation bursts from Godiva was completed. To correlate calculated and experimental shapes of indoor bursts, delayed neutron groups characteristic of room-return were added. A new quadruple fission comparison chamber with active materials confined to $\frac{1}{8}$"-long coatings was used to refine values for fission ratios in Topsy. Indium, Au, and Mn resonance detectors were run in the OyO_2F_2–D_2O assembly at a D/Oy ratio of 214. Fission chamber measurements in the solution show fission ratios of 3.06 for 49/25 and 1.80 for 23/25 when normalized to central Topsy values. Fission spectra obtained from 25 and 49 fission plates in the water boiler thermal beam were compared by means of fission chambers and threshold detector foils. Tests completed on the revised model of the slug transfer system show that the system is successful. (J.R.D.)

31001 (UCID-4171) HOT BOX FUEL ELEMENT WEIGHTS: 2-Mil FOILS. Hot Box Note Number 29. R. G. Finke (California. Univ., Livermore. Lawrence Radiation Lab.). June 29, 1960. Contract [W-7405-eng-48]. 8p.

A list of oralloy in each 2-mil Hot Box fuel element is presented. The average wt of each 2-mil oralloy foil is 122.7 g. The fraction of the oralloy wt which is U^{235} is given as 0.93175. (J.R.D.)

31002 CRITICAL EXPERIMENTS ON NATURAL URANIUM OXIDE, ORGANIC COOLED, HEAVY WATER MODERATED LATTICES. G. Casini, C. Foggi, and F. Toselli (Euratom CCR, Ispra, Italy). Energia nucleare, (Milan), 9: 455-61(Aug. 1962). (In English)

A series of critical experiments was carried out at Saclay, France, by the Reactor Physics Department of the C.C.R., Euratom. The purpose of the measurements was to determine the material buckling of nine different ORGEL lattices using natural uranium oxide fuel elements, moderated by heavy water and cooled by an organic liquid. The experimental technique, the results obtained, and their comparison with calculated values are described. The latter turn out to be systematically lower than the former. Some criteria are given to improve the agreement between the two sets of values. (auth)

Elementary Particles and Radiations

31003 (AROD-442: 9) AN EXPERIMENTAL STUDY OF ATOM-ION COLLISIONS PRODUCING LYMAN ALPHA

RADIATION. Interim Technical Report. Gordon H. Dunn (Washington. Univ., Seattle). Apr. 11, 1962. Contract Nonr 477(32). 116p.

An ion beam apparatus useful for studies of electron-ion and ion-neutral collisions was built and put into successful operation. Absolute cross sections for the production of Lyman alpha radiation from the impact of ions on neutrals were measured as a function of ion energy. The ion-gas combinations studied and the respective energy ranges are: H^+-H_2, 0.5 to 3 kev; H_2^+-H_2, 0.2 to 3 kev; H_3^+-H_2, 0.6 to 5.5 kev; He^+-H_2, 0.015 to 2 kev; A^{++}-H_2, 0.2 to 0.6 kev; H^+-He, 2.8 kev; H_2^+-He, 0.5 to 8 kev; and H_3^+-He, 0.9 to 4 kev. In addition the absolute cross sections for production of countable ultraviolet radiation by the impact of H^+, H_2^+, H_3^+, and He^+ on nitrogen were measured in the energy interval 0.6 to 4 kev. Results are discussed from the standpoint of the adiabatic theory, and general agreement with the theory is noted. The cross sections for $H^+ + H_2$, $H_2^+ + H_2$, $He^+ + H_2$, and $H_2^+ + He$ were satisfactorily fitted to an exponential in the adiabatic region. Functional fits were not attempted for the other processes listed. The adiabatic interaction distance "a" was calculated from the adiabatic maximum rule for the processes, $He^+ + H_2$ and $H_2^+ + He$, and found to be 1.4 and 1.9Å respectively. Calculations of "a" from the exponential rate of rise of the cross section gave values of 3 and 3.5Å for the same respective processes. This method gave "a" values of 6 and 7.5 Å for the $H_2^+ + H_2$ and $H^+ + H_2$ processes respectively. These "a" values were compared with those known for other processes. The mechanism responsible for production of Lyman alpha in the $He^+ - H_2$ impact is identified as a dissociative charge exchange to an excited state. Reasons are set forth which show that the total charge exchange between He^+ and H_2 at the low energies is probably due to a sum of processes of the type measured, i.e. dissociative charge exchange to excited states. This is in contrast to an earlier interpretation by Hasted who suggested that it is due to dissociative charge exchange to the $2p\sigma_u$ state, one yielding a proton and a ground state atom. The $He^+ - H_2$ and $H_2^+ - He$ collisions are discussed from the standpoint of similarities between them. The probability was measured for obtaining countable ultraviolet radiation from the impact of H_2^+ on a metal surface. The experimental value of 5×10^{-3} photons/ion is high compared to Shekhtar's value of 5×10^{-7} calculated for neutralization of an ion at a metal surface by radiating the excess energy. The difference is tentatively ascribed to layers of adsorbed gas on the experimental surface. Progress in the performance of three experiments involving ion-electron collisions is described: $H_2^+ + e \rightarrow H^+ + H^*$, dissociative recombination; $H_2^+ + e \rightarrow H + H^+ + e$, dissociation; and $He^+ + e \rightarrow He^{++} + 2e$, ionization. Difficulties encountered with these experiments and necessary remedies are discussed. Further possible programs involving excitation in atomic collisions are discussed from the standpoint of adaptability to the apparatus which was built. (auth)

31004 (BNL-5084) A REMARK ON THE MEASUREMENT OF THE ANOMALOUS MAGNETIC MOMENT FORM FACTOR OF THE PROTON AT LARGE MOMENTUM TRANSFERS. Loyal Durand, III (Brookhaven National Lab., Upton, N. Y.). Nov. 18, 1960. Contract [AT(30-2)-Gen-16]. 5p.

A discussion is presented concerning the charge and anomalous magnetic moment form factors $F_{1,p}$ and $F_{2,p}$ that are functions of the electron 4-momentum transfer q^2 as introduced into the proton current operator to allow for the mesonic structure of the proton. Information on $F_{2,p}$ at larger than presently used values of q^2 can be obtained if the assumption is made that $F_{1,p}$ does not vary rapidly for $q^2 > 25f^{-2}$, but rather maintains the gradual drift toward smaller values characteristic of the region $f^{-2} < q^2 < 25f^{-2}$. (J.R.D.)

31005 (BNL-6213) MULTIPLE MESON PRODUCTION IN π^--p COLLISIONS AT 4.7 Bev/c. N. P. Samios (Brookhaven National Lab., Upton, N. Y.); A. H. Bachman, R. M. Lea (City Coll., New York); T. E. Kalogeropoulos (Columbia Univ., New York); and W. D. Shephard (Kentucky. Univ., Lexington). [1962]. Contract [AT-30-2-GEN-16]. 10p.

A study was made of ~1300 four-prong events obtained by exposing a liquid hydrogen bubble chamber to a 4.7 Bev/c π^- beam. The effective mass distributions for 2 and 3 body combinations that exhibit resonances are presented. The production hypotheses considered for each event were: $\pi^- + p \rightarrow 2\pi^- + \pi^+ + p$, $\pi^- + p \rightarrow 2\pi^- + \pi^+ + p + \pi^0$, $\pi^- + p \rightarrow 2\pi^- + p + \pi^+$, $\pi^- + p \rightarrow 2\pi^- + 2\pi^+ + n$, and $\pi^- + p \rightarrow 2\pi^- + 2\pi^+$. (M.C.G.)

31006 (BNL-5151) THE MILNE PROBLEM FOR A NON-ABSORBING MEDIUM WITH LINEARLY ANISOTROPIC SCATTERING. Hiroshi Takahashi (Brookhaven National Lab., Upton, N. Y.) Dec. 1960. Contract [AT(30-2)-Gen-16]. 18p.

The Milne problem in a non-absorbing semi-infinite medium with linearly anisotropic scattering was solved by direct factorization of simultaneous integral equations. The resulting expression was simpler than that obtained by other methods and shows that anisotropic scattering does not affect the transient flux distribution but only the asymptotic flux distribution. (auth)

31007 (CERN-62-18) SELECTED TOPICS ON SCATTERING THEORY. PART I. RELATIVISTIC KINEMATICS AND PRECESSION OF POLARIZATION. (European Organization for Nuclear Research, Geneva). May 21, 1962. 147p.

Lectures on scattering theory are presented. Topics covered include: Lorentz transformations and invariants, choice of a system of units, some practical examples for the use of invariants, the Lorentz transformation to the rest system of an arbitrary particle (or to the center-of-momentum system), the transformation of differential cross sections Jacobian determinants, variables and coordinate systems frequently used in elastic scattering, short considerations on relativistic notation, and precession of the polarization of particles moving in an electromagnetic field. (M.C.G.)

31008 (CERN-62-21) SOME DETAILS OF THE ANALYSIS OF NEUTRAL V-EVENTS IN A HEAVY LIQUID BUBBLE CHAMBER. H. H. Bingham, M. Di Corato, E. S. Gelsema, and A. Minguzzi-Ranzi (European Organization for Nuclear Research, Geneva). July 3, 1962. 24p.

The method used for analysis of neutral V-events in a propane bubble chamber produced by mesons (π^-) of momenta 6.2, 11.6, and 18.1 Bev/c is described. The scanning of films was carried out on Prevost scanning tables. Special measurements were made to determine the distortion in the chamber and instrumental errors. Modifications of the program used for analyses of the events are discussed along with corresponding changes in the procedure of the preparation of measurements. Histograms are shown, presenting some significant distributions, illustrating the internal consistency of the procedure. (M.C.G.)

31009 (JINR-E-1012) DETERMINATION OF THE ROOT-MEAN-SQUARE RADIUS OF TRANSITION $He^3 - H^3$. B. V. Struminskii (Struminsky) (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 5p.

It is shown that the mean-square radius of transition $He^3 - H^3$ can be calculated if the ratio of Panofsky for He, the ratio of the probabilities of the processes $\pi^- + He^3 \rightarrow t^3 + \pi^3$ and $\pi^- + He^3 \rightarrow H^3 + \gamma$, is known. A value for the radius of transition of $1.24^{+0.38}_{-0.46} \times 10^{-13}$ cm was obtained. (M.C.G.)

31010 (KFK-83) BEMERKUNGEN ZUR ELEKTRONENSTREUUNG AN NUKLEONEN IM BEREICH VON 6 Gev. (Remarks on Electron Scattering on Nucleons in the Region of 6 Bev). Herwig Schopper (Kernforschungszentrum. Institut fÜr Experimentelle Kernphysik, Karlsruhe, Germany). Feb. 1962. 38p.

A method for determination of the form factors from the effective cross sections is discussed. Previous experimental results with protons and neutrons are reviewed. The target, determination of the intensity of the primary radiation, counters, and spectrometers are described. Coincidence experiments included elastic scattering by protons and quasi-elastic scattering by deuterons. Polarization experiments are discussed. (M.C.G.)

31011 (NP-12028) RELATIVISTIC QUANTUM THEORY OF PARTICLES WITH VARIABLE MASS. H. C. Corben (Space Technology Labs., Inc., Redondo Beach, Calif.). Aug. 1962. Contract Nonr-3769(00). 49p.

With the classical theory used as a guide, general conditions are derived for a linear field theory in order that it meet the requirements of quantum theory and relativity theory. If one does not demand that the mass be a c-number, the spin is required to be the sum of two commuting operators, one of which describes the spin in the constant mass case. Three expressions for the mass operator consistent with the general requirements are obtained, and these are shown to lead to a new description of particles of spin 0, $\frac{1}{2}$, 1, $\frac{3}{2}$, and 2. These expressions are equivalent to adding extra terms to the Dirac or Kemmer-Duffin equations. Apart from numerical constants, the rest-energy eigenvalues, charges, spins, and decay mechanisms of these particles are unambiguous consequences of the theory. The theory is applied to bosons and fermions. Equations are obtained when the γ_i are the Dirac operators and the η_i are either the Dirac or Kemmer-Duffin operators, the constant additive term in the mass operator being taken to be zero or equal to the electron mass. (auth)

31012 (TID-11120) A VARIANT OF THE BETHE-GOLDSTONE EQUATION. Walter B. Goad (Los Alamos Scientific Lab., N. Mex.). [1958]. Contract [W-7405-Eng-36]. 7p. (LADC-4607)

The Bethe-Goldstone wave equation for pairs of Fermi particles embedded in a larger medium was derived by an approximate treatment of the interaction of trios of particles. The approximation involves an average over the position of one of the particles using a pair correlation function. The effect of applying the Pauli principle to the entire medium is reproduced when the correlation function is that of an ideal Fermi gas. (auth)

31013 (TID-16419) THE DETERMINATION OF LOW ENERGY MASS ATTENUATION COEFFICIENTS OF ARGON (6-24 kev) AND CARBON DIOXIDE (6-12 kev) (thesis). William Gordon Buckman (Vanderbilt Univ., Nashville). June 1962. 45p.

A review is presented concerning previous work followed by a description of the experimental apparatus used for determining low-energy x-ray attenuation. The procedure used for acquiring data on a particular gas for each x-ray energy is also described. An analysis of attenuation coefficients is given which includes method of calculating results and a description of errors. Data are presented graphically. (J.R.D.)

31014 (UCRL-6269) A CONNECTION BETWEEN TWO METHODS FOR CALCULATING ELECTRON-ATOM SCATTERING. Marvin H. Mittleman (California. Univ., Livermore. Lawrence Radiation Lab.) and Robert Pu (California. Univ., Berkeley). Jan. 4, 1961. Contract W-7405-eng-48. 5p.

Calculation of electron scattering by atoms using the methods of closely coupled states, and optical potentials are considered. Each of these principles is exact, but assumptions required in practical calculations may cause the yield of different results. It is shown that the two methods can be combined by separating the atomic states into two classes: those which are closely coupled to the initial (ground) state, and those which are not. A method of deriving equations for the coupled states is described which allows for the simple excitations to the remaining states. (J.R.D.)

31015 (UCRL-9413) THE STATISTICAL GEOMETRY OF BUBBLE TRACKS. Walter H. Barkas (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 28, 1960. Contract W-7405-eng-48. 8p.

An exact treatment of the structure of tracks in nuclear emulsion was previously attempted. A summary is presented of the results that are applicable to tracks of charged particles in bubble chambers. Conditions and definitions required to measure the mean linear density of sites on which bubbles grow are given. (M.C.G.)

31016 (UCRL-9517) THE ADIABATIC MOTION OF CHARGED PARTICLES IN ELECTROMAGNETIC FIELDS. Theodore G. Northrop (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 1961. Contract W-7405-eng-48. 104p.

The equations of motion of a charged particle in an electromagnetic field were used to obtain the so-called "guiding center" motion. In a slowly varying field the particle motion is approximately a rapid rotation about a circle whose center (the guiding center) has velocity components along and at right angles to the magnetic field. The equations governing the guiding center motion were obtained deductively for the general time-dependent field. Several unfamiliar drifts appeared because the time dependence and the perpendicular electric field were assumed, for the sake of generality, to be zero order in the radius of gyration rather than first order. These less familiar drifts are illustrated via practical examples where they occur. The modifications of the guiding center equations needed for particles of relativistic energy are given. The three adiabatic invariants of the particle motion are defined and the invariance proven for the general case of time dependent fields. Several applications were made of the guiding center equations of motion and the adiabatic invariants. Finally, deviations from the adiabatic predictions are discussed. (auth)

31017 (UCRL-9553) KINEMATICS AND DISPERSION RELATIONS FOR GENERAL PRODUCTION PROCESSES. Martin Kretzschmar (California. Univ., Berkeley. Lawrence Radiation Lab.). Feb. 2, 1961. Contract W-7405-eng-48. 58p.

On the basis of heuristic arguments it is shown that the amplitude for the reaction $a_1 + a_2 \rightarrow b_1 + b_2 + b_3$ and the channels associated with it allows a dispersion representation analogous to that given by Mandelstam for processes of type $a_1 + a_2 \rightarrow b_1 + b_2$, provided that the singularities of the amplitude can be assumed to be restricted, in complete analogy to Mandelstam's case, to certain parts of real hyperplanes in the (complex) space of the invariant variables $s_{jk} = (q_j + q_k)^2$. (Here the $q_i (i = 1,2,\cdots,5)$ are the particle four-momenta.) A Lorentz-invariant description due

to Kibble for the boundary of the physical region of the process $a_1 + a_2 \rightarrow b_1 + b_2$ was generalized for arbitrary reactions and discussed in terms of scattering angles for some special cases. After suitable generalization of the Breit frame a set of ten one-dimensional dispersion relations analogous to the three one-dimensional relations of Mandelstam was obtained by using a method due to Polkinghorne. Each relation apart from pole terms consists of six dispersion integrals, each of which corresponds to a certain reaction channel. The absorptive parts were obtained from analytic continuation of the unitarity condition in the respective channel. For obtaining such a result it was essential to keep fixed not four variables of type s_{ik} but three such variables and a fourth variable ν, which was formerly introduced by Polkinghorne and which is a generalized linear function of those s_{ik}, which was not kept fixed. Provided that there are no complex singularities each of these one-dimensional dispersion relations can—in a formal way—be derived from a two-dimensional representation, in which certain three variables s_{ik} are fixed and which consists of twelve double integrals. It is suggested that if there was analyticity with regard to all variables and only real singularities a possible representation in terms of fivefold dispersion integrals would be of considerable complexity and consist of at least 162 terms. (auth)

31018 (UCRL-9575) BREMSSTRAHLUNG. R. W. Kenney (California. Univ., Berkeley. Lawrence Radiation Lab.). Feb. 1961. Contract W-7405-eng-48. 7p.

The case of an electron whose total energy is $E_0 \geq 800/Z$ Mev as it traverses matter of atomic number Z is considered. The electron loses energy chiefly by bremsstrahlung. A beam of energetic electrons incident on a radiator produces a bremsstrahlung beam that is directed sharply forward. Curves showing angular distributions for W targets are included along with curves showing the effect of electron scattering on the basic spectral shape and curves showing examples of thick radiator spectra (bremsstrahlung cross sections). (J.R.D.)

31019 (UCRL-9675) THE Σ/Λ BRANCHING RATIO OF Y_1. Margaret H. Alston, Luis W. Alvarez, Philippe Eberhard, Myron L. Good, William Graziano, Harold K. Ticho, and Stanley G. Wojcicki (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Apr. 25, 1961. Contract W-7405-eng-48. 15p.

Theoretical branching ratios for the T = 1 resonance Y_1^* in the Λ-π system are discussed. Studies were made of K^--p interactions at 1.15 Bev/c for $Y_1^{*+} \rightarrow \Sigma^+ + \pi^0$, $Y_1^{*+} \rightarrow \Sigma^0 + \pi^+$, and $Y_1^{*0} \rightarrow \Sigma^+ + \pi^-$. It was concluded that the Σ/Λ branching ratio for the strong decay of the T = 1 Y_1^* is at most a few percent and is consistent with zero. (M.C.G.)

31020 (UCRL-10222) ELASTIC K^--p SCATTERING BETWEEN 700 AND 1400Mev/c. E. F. Beall, W. Holley, D. Keefe, L. T. Kerth, J. J. Thresher, C. L. Wang, and W. A. Wenzel (California. Univ., Berkeley. Lawrence Radiation Lab.). May 24, 1962. Contract W-7405-eng-48. 12p.

Results of a spark-chamber study concerning K^--p interactions at about the 1.05-Bev resonance are presented. Analytical determinations are shown graphically as center-of-mass differential cross sections. The experimental procedure is described. (J.R.D.)

31021 (UCRL-10253) SCATTERING OF NEGATIVE PIONS ON PROTONS AT 310 Mev: RECOIL-NUCLEON POLARIZATION AND PHASE-SHIFT ANALYSIS (thesis). Olav T. Vik (California. Univ., Berkeley. Lawrence Radiation Lab.). May 21, 1962. Contract W-7405-eng-48. 71p.

The recoil-proton polarization in π^--p elastic scattering at 310 Mev was measured in the angular region 114 deg < $\theta_{c.m.}$ < 146 deg. These data were incorporated with other polarization and differential cross-section data at this energy, and a phase-shift analysis was performed. Recoil-proton polarization was measured at four angles with results: 0.784 ± 0.132 at 114.2 deg, 0.648 ± 0.076 at 124.5 deg, 0.589 ± 0.072 at 133.8 deg, and 0.304 ± 0.055 at 145.2 deg. A beam of 3×10^6 pions/sec was incident on a liquid H_2 target; the resultant recoil protons were then scattered from C target and the left-right asymmetry measured. Plastic scintillation counters were used throughout. An IBM 7090 search program was developed, and the above data were incorporated with data on π^+-p polarization and differential and total cross section, π^--p differential and total cross section, and charge-exchange differential cross section. A phase-shift analysis was performed. Analysis for spd waves (up to $l = 2$) shows the existence of a single satisfactory solution to all the available data. This solution is of the Fermi type in the $I = 3/2$ phase shifts, and its $I = 1/2$ phase shifts are all small (<6 deg), with the exception of the $D^{1/2}$ shift, which is ≈15 deg. Errors on the phase shifts vary from 0.4 through 1.1 deg. Extension of the analysis to spdf waves ($l = 3$), allows three satisfactory solutions, one of which is an extension of the spd solution. The other two solutions are also of the Fermi type with $I = 3/2$ phase shifts, but the dominant $I = 1/2$ phase shift is the $P^{1/2}$ shift, which is >20 deg in both cases. The phase-shift errors are larger for these three solutions, ranging up to 2 deg. The single spd solution and the three spdf solutions are discussed and compared with theoretical predictions. (auth)

31022 (UCRL-10330) AN INVESTIGATION OF SOME EXPERIMENTAL CONSEQUENCES OF ANALYTIC CONTINUATION IN ENERGY FOR STRONG-INTERACTION PARTIAL-WAVE AMPLITUDES (thesis). Louis A. P. Balázs (California. Univ., Berkeley. Lawrence Radiation Lab.). June 25, 1962. Contract W-7405-eng-48. 62p.

A general method for setting up effective-range formulas is presented. Known nearby singularities can be taken into account exactly. The method is applied to the $^1S_0$ nucleon-nucleon state in the range 0 to 100 Mev and the $I = 1/2$, $J = 1/2$ state in πN scattering in the range 0 to 220 Mev. In the latter case, the two parameters can be calculated from the pion and nucleon masses and the πN coupling constant (f^2), on the assumption that the nucleon is a bound state. A method is also given for calculating effective-range parameters from partial-wave amplitudes in the crossed channel, with ππ scattering as an example. This, in turn, makes it possible to carry out dynamical calculations and to calculate Regge poles at low energies. (auth)

31023 (UCRL-10331) HIGH-ENERGY NUCLEON-NUCLEON SCATTERING (thesis). Ivan J. Muzinich (California. Univ., Berkeley. Lawrence Radiation Lab.). June 26, 1962. Contract W-7405-eng-48. 61p.

The nucleon-nucleon problem is discussed from the standpoint of analyticity in angular momentum. A unique continuation of the partial-wave helicity amplitudes is given. The high-energy nucleon-nucleon problem is then considered from the point of view of the various Regge poles that have the same quantum numbers as the nucleon-antinucleon channel. In particular, the contribution of these Regge trajectories to nucleon-antinucleon scattering and, hence, their contribution by crossing to nucleon-nucleon scattering is given. The resulting formulas should

be adequate to describe the total cross section and angular distribution for energies greater than approximately 3 Bev in the laboratory system. (auth)

31024 (UCRL-10340) PION-PION INELASTIC COLLISIONS (thesis). Martial Leon Thiebaux, Jr. (California. Univ., Berkeley. Lawrence Radiation Lab.). June 29, 1962. Contract W-7405-eng-48. 61p.

The strip approximation procedure of Chew and Frautschi was applied in the pion-pion problem to estimate the cross section for the process $2\pi \rightarrow 4\pi$ considered in its full isotopic spin generality. The main results are dependent on s-wave scattering-length formulas for low-energy pion-pion scattering. The scattering lengths chosen are those due to Schnitzer's analysis of data from $\pi + N \rightarrow 2\pi + N$ experiments. The inelastic cross sections for the production of two s-wave pairs are found to attain maxima of less than 0.001 $(m_\pi)^{-2}$ at total energies of about 11 m_π. Arguments based on the geometry of the double spectral functions suggest these results are accurate in the energy range from threshold at 4 m_π to 8 m_π. An attempt was also made to estimate quantitatively to what extent the four final pions emerge in two well-defined pairs. On the basis of a crude estimation, the cross section for ρ-meson production was found to go through a maximum of about 0.026 $(m_\pi)^{-2}$ at an energy of 13 m_π, but ρ production is probably not significant at energies below 8 m_π. (auth)

31025 (UCRL-10348) HYPERON PRODUCTION BY K^- INTERACTIONS IN DEUTERIUM (thesis). Orin Iver Dahl (Califonia. Univ., Berkeley. Lawrence Radiation Lab.). July 3, 1962. Contract W-7405-eng-48. 67p.

Hyperon production by K^- interactions in deuterium at a laboratory-system momentum of 200 Mev/c is described. The experimental setup and PACKAGE-EXAMIN data-analysis system are also described. The spearation of interactions at rest and in flight is discussed in detail. The reactions are dominated by three-body final states. Branching ratios between the several final states provide two independent verifications of the charge-independence hypothesis. The ratios are in reasonable agreement with those predicted from the K^- p interaction. Analysis of the energy distributions in the final state indicates the presence of final-state scattering as well as a dominating impulse type of K^- nucleon interaction. (auth)

31026 (FTD-TT-62-924) THE PHYSICS OF HIGH ENERGY AND ELEMENTARY PARTICLES. V. M. Fedorov. Translated from Vestnik Akad. Nauk S.S.S.R., 30: No. 8, 120-1(1960). 4p.

Presentations at the Fourth All-Union Conference on the Physics of High Energy and Elementary Particles are summarized briefly. (M.C.G.)

31027 ANALYTICAL PROPERTIES OF THE AMPLITUDE OF ELASTIC $\pi\pi$-SCATTERING IN THE l-PLANE. G. Domokosh (United Inst. of Nuclear Studies, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1279-80(June 1962). (In Russian)

If the partial amplitude of π-π scattering is "meromorphic" with respect to l, the quantum mechanical results of Regge can be generalized to a field theory. Integral equations of the Chew-Mandelstam type were written in order to determine the partial amplitudes. The set of equations were solved by iteration. It is shown that the equations are of the Fredholm type, and that the amplitude $A_l^I(\nu)$ is meromorphic (behaves like a fraction) with respect to l. It can also be shown that if $|A_l^I(\nu)|$ at $\nu > 0$ goes smoothly to a certain limiting function, the amplitude itself is meromorphic with respect to l. If the analytical properties are known, a zero approximation can be conveniently selected by choosing one Regge-pole. (TTT)

31028 THE EFFECT OF FORCED CRYSTAL VIBRATIONS ON THE SPECTRUM OF SCATTERED γ-QUANTA. I. P. Dzyub and A. F. Lubchenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R., 145: 73-5(July 1, 1962). (In Russian)

The frequency dispersion of normal lattice vibrations can be derived from the spectrum of scattered γ quanta or neutrons, but it is difficult to obtain good statistics with a weak source of monochromatic γ rays such as a Mössbauer source. On the other hand, forced vibrations can be excited in a crystal with an ultrasonic quartz generator, and secondary peaks will appear in the radiation spectrum. These peaks have an intensity which is comparable or greater than the intensity of the Mössbauer line. The peaks are at a distance $n\omega_q$ from the principal Mössbauer line. Here $n = \pm 1, \pm 2 \ldots$, and ω_q is the ultrasonic frequency. The system of the crystal and of the electromagnetic field is described by the Hamiltonian: $H = H_0 + H_a + H_e + H_1 + H_2$. Here H_0 is the Hamiltonian describing the lattice vibration, H_a is the Hamiltonian of the internal state of atom and nucleus, H_e is the Hamiltonian of the free electromagnetic field, and H_1 and H_2 are Hamiltonians describing the interaction of the crystal with the external source, and the Hamiltonian of the electromagnetic interaction respectively. The mathematical analysis shows that narrow lines having a frequency $\omega_{\lambda l} = \omega_\lambda \pm m\omega_q$ will be observed in the spectrum of γ quanta. The ratio of the intensities of the scattered γ quanta is determined by the value of $2\pi|a|/d$, where d is the lattice constant of the scattering material, and $\underline{a}$ is the amplitude of the vibration. With $|a| = 0.1d$, the relative intensities of the lines with $m = 0$ and $m = 1$ are 0.81 and 0.09 (all the harmonics with $m > 2$ comprise 0.01 of the scattered γ quanta). With $|a| = 0.13$ d, the relative intensities are 0.70 and 0.13 (the higher harmonics are 4% of the total scattered γ quanta). (TTT)

31029 THE CALCULATION OF REGGE POLES. G. Domokosh (United Inst. of Nuclear Studies, USSR). Doklady Akad. Nauk S.S.S.R., 145: 76-7(July 1, 1962). (In Russian)

It was previously shown that a Regge pole, which determines the diffraction scattering at high energies, possesses the following properties: 1) L(t) is holomorphic in the t-plane with a discontinuity from $t = 4$ to infinity, 2) $dL/dt > 0$ at $t < 4$, and 3) $L(0) = 1$. The following properties can be added from considerations of continuity and properties 1 to 3: 4) $\mathrm{Im}L = 0[(t-4)^{\mathrm{Re}L(4)+\frac{1}{2}}]$ as $t \rightarrow 4 + 0$; 5) the Riemann surface, corresponding to the branching point at $t = 4$, is double-lobed; 6) $L(t) < 2$ at $t < 4$, since a bound state with quantum numbers $I = 0$ and $J = 2$ was not observed experimentally; and 7) there are no "imaginary" states. As condition A it follows from properties 2 to 6 that $\mathrm{Re}L(4) = 2$. In order to satisfy 1), L is represented in the form of a series by the following variable: $\eta = -t[2 + \sqrt{4-t}]^{-2}$. Condition B, as derived from property 4 and condition A, is that at $t > 4$ the coefficients from $i(t-4)^{\frac{1}{2}}, \ldots i(t-4)^{\frac{1}{2}}$ are equal to zero. Condition C is that $L(t) > 0$. Conditions A, B, and C give six equations for the coefficients η^n in the series function of L. Then, it is assumed that $L(t) \approx 1 + \sum_{n=1}^{5} c_n \eta^n$ in order to obtain a set of 6 linear equations for the c_n coefficients. With this equation and another equation, the distribution πN diffraction scattering was calculated, and was found to agree with experimental results for 5 and 7 Bev pions. It is believed that this procedure can be formulated as a general method of obtaining Regge poles. (TTT)

31030 GENERALIZED EQUATIONS OF SUPERCONDUCTIVITY. L. P. Rapoport and A. G. Krylovetskii (Vononezhskii State Univ., USSR). Doklady Akad. Nauk S.S.S.R., 145: 771-4(Aug. 1, 1962). (In Russian)

Equations are derived that describe the superconductivity of a system of fermions in an inhomogeneous medium at an arbitrary temperature. In deriving the equations, a limitation is placed only on the rate of change and the width of the energy gap. The equation obtained differs from the Ginsberg-Landau equation only by its clear dependence on temperature, the presence of an energy gap, and by doubling of the electron charge. These concepts are easily related to the facts of superconductivity phenomena. The equations describe a quantum vortex in a system of fermions which are in a superfluid state at a temperature T (not just at the critical temperature T_c). (TTT)

31031 EXPERIMENTAL STUDY ON THE PENETRATION OF ^{60}Co γ-RAY THROUGH FINITE HETEROGENEOUS MEDIA. [PART] I. Hiroji Mochizuki, Yoshihisa Tanaka, Yoshiharu Higashihara, Kohtaro Nagato, and Katsu-aki Yorihisa (Kawasaki Dockyard Co. Ltd., [Japan]). Nippon Genshiryoku Gakkaishi, 4: 448-56(July 1962). (In Japanese)

Buildup factors are obtained experimentally for heterogeneous media, composed of various combinations of materials (H_2O, Fe, and Pb), for Co^{60} γ rays. On the basis of the results, an empirical formula is obtained that is acceptable physically and capable of quick and easy calculation of buildup factors for heterogeneous media composed of arbitrary combinations of materials, by using known buildup factors for the finite homogeneous media of the materials included in the compound. Experimental buildup factors do not vary more than 10% from the calculated values for a shield thickness of 0 to 6 mfp and for a Co^{60} γ ray source. The experimental results obtained indicate that the buildup factors agree with theoretical values for iron, lead, and multilayers of materials using relatively small thicknesses of lead slabs, but not for water and multilayers using large thicknesses of lead slabs. The effect of the heterogeneity of compounds on the buildup factors is also investigated. (auth)

31032 TWO-PION FORCE AND THREE-PION SYSTEM. G. Eder (Universität, Vienna). Nuclear Phys., 37: 83-9(Aug. 1962). (In English)

A δ-type π-π potential is used to describe the π-π scattering up to the ρ-resonance. With this potential a three-pion system is investigated for the state J = 1 and T = 0. It seems possible to understand the ω-particle as a metastable state of such a system. (auth)

31033 ON THE POSSIBILITY OF DETERMINING THE SIGN OF THE DECAY AMPLITUDE $\pi^0 \rightarrow 2\gamma$. D. V. Volkov and M. P. Rekalo (Khar'kov Inst. of Physics and Tech.). Nuclear Phys., 37: 172-5(Aug. 1962).

Interference effects in the photoproduction of π^0 mesons in the nucleus are considered. It is shown that the study of these effects in the γ-quantum energy region of 500 to 700 Mev can make possible the determination of the (relative) sign of the amplitude of the decay $\pi^0 \rightarrow 2\gamma$. (auth)

31034 BREMSSTRAHLUNG FROM POLARIZED ELECTRONS. W. R. Johnson and J. D. Rozics (Univ. of Notre Dame, Ind.). Phys. Rev., 128: 192-7(Oct. 1, 1962).

The production of unpolarized bremsstrahlung by polarized electrons in the Coulomb field of a nucleus is considered. An approximate analytical expression for the differential cross section summed over final electron spins is presented. This differential cross section is integrated numerically over angles of the emitted electron to determine the asymmetry in the photon angular distribution. Results of the numerical integration are given for incident electron velocities in the range $0.4c \leq v \leq 0.9c$. (auth)

31035 $K_1^0 - K_2^0$ MASS DIFFERENCE. U. Camerini (Univ. of Wisconsin, Madison), W. F. Fry, J. A. Gaidos, H. Huzita, S. V. Natali, R. B. Willmann, R. W. Birge, R. P. Ely, W. M. Powell, and H. S. White. Phys. Rev., 128: 362-7(Oct. 1, 1962).

A measurement of the magnitude of the $K_1^0 - K_2^0$ mass difference yields $(1.5 \pm 0.2)\hbar/\tau_1 c^2$. The method employed consisted of measuring the time dependence of the $\overline{K}^0$ intensity, in a beam which was initially in a pure K^0 state. The $\overline{K}^0$ intensity was measured by observing nuclear interactions. The K^0 mesons were produced by the charge exchange of K^+ mesons of 800-Mev/c momentum. (auth)

31036 PRODUCTION OF Σ^+K^+ BY (π^+,p) INTERACTION AT 1170 Mev/c. Frank S. Crawford, Jr., Fernand Grard, and Gerald A. Smith (Univ. of California, Berkeley). Phys. Rev., 128: 368-73(Oct. 1, 1962). (UCRL-10154)

The reaction $\pi^+ + p \rightarrow \Sigma^+ + K^+$ has been studied at 1170 Mev/c in the 72-in. liquid hydrogen bubble chamber. An analysis of 251 events gave a total cross section of 0.205 ± 0.014 mb and values of $\alpha^0 \overline{P}_{\Sigma^+} = 0.62 \pm 0.19$, $\alpha^+ \overline{P}_{\Sigma^+} = -0.18 \pm 0.13$. Based on the differential cross section and Σ^+ polarization, the s-, p-, and d-wave amplitudes were determined:

$$s_{1/2} = a = 0.061 \pm 0.016 \text{ (mb/sr)}^{1/2},$$
$$(p_{1/2} + 2p_{3/2})/s_{1/2} = b \exp(ix_b)/a = (2.14 \pm 1.13) \exp[i(34.7 \text{ deg} \pm 29.2 \text{ deg})],$$
$$(p_{1/2} - p_{3/2})/s_{1/2} = c \exp(ix_c)/a = -(1.46 \pm 1.78) \exp[i(20.5 \text{ deg} \pm 26.1 \text{ deg})],$$
$$(3d_{3/2} + 2d_{5/2})/s_{1/2} = d \exp(ix_d)/a = -(1.02 \pm 0.97) \exp[i(-7.4 \text{ deg} \pm 66.2 \text{ deg})],$$

and

$$(d_{3/2} - d_{5/2})/s_{1/2} = e \exp(ix_e)/a = -(0.72 \pm 0.63) \exp[i(91.9 \text{ deg} \pm 25.8 \text{ deg})].$$

An alternative set of solutions exists for the transformations $x_b \rightarrow -x_b$, $x_c \rightarrow 180 \text{ deg} - x_c$, $x_d \rightarrow -x_d$, $x_e \rightarrow 180 \text{ deg} - x_e$. Based on extrapolation of s and p amplitudes obtained near threshold in a previous experiment in which angular distribution, polarization, and energy dependence were used, an attempt has been made to resolve the Minami ambiguity in the amplitudes of this experiment. Currently available data of Σ^- and Σ^0 production by (π^-,p) interaction at 1220 Mev/c were used to test the charge-independence hypothesis. Within the limits of statistical accuracy, no evidence of a violation of charge independence was observed. (auth)

31037 DECAY RATES OF NEUTRAL MESONS. Donald A. Geffen (Univ. of Minnesota, Minneapolis). Phys. Rev., 128: 374-7(Oct. 1, 1962).

The model of Gell-Mann, Sharp, and Wagner for relating the $\omega \rightarrow \pi^+ + \pi^- + \pi^0$ decay rate to the π^0 lifetime is examined. It is shown that, if present experimental results, finding large structure effects in the π^0 decay form factor, are confirmed by more precise data, then Gell-Mann et al., have considerably underestimated the $\omega \rightarrow 3\pi$ decay rate. The branching ratio $\Gamma(p \rightarrow \pi + \gamma)/\Gamma(p \rightarrow 2\pi)$ is also greatly enhanced, becoming a percent or more. The possibility that the η is a 1^{--} meson is discussed briefly. It is found that, in terms of the model, the 1^{--} assignment of quantum numbers for the η does not appear likely. (auth)

31038 APPROXIMATE SYMMETRIES IN THE TWO-NEUTRINO THEORY. F. Feinberg (Columbia Univ., New York) and F. Guersey. Phys. Rev., 128: 378-85(Oct. 1, 1962).

It is shown that if there are two neutrinos, the Lagrangian of the electromagnetic interactions and the leptonic weak interactions which preserve strangeness are invariant under three-dimensional rotations in an internal "leptonic spin" space. These rotations transform ν_1 into ν_2 and e into μ. Only the μ-e mass difference does not satisfy this invariance. Some consequences of the symmetry for lepton scattering experiments are discussed. Extensions of the symmetry to other leptonic interactions are considered. In the "conventional" two-neutrino theory, all weak interactions obey the symmetry, and the baryons and mesons are scalars under the rotations. Alternative possibilities in which the baryons form multiplets in leptonic spin space are also presented and their relation to the suggestion of "neutrino flip" interactions is discussed. (auth)

31039 CURRENT CONSERVATION AND $|\Delta T| = \frac{1}{2}$ RULE IN θ DECAY. Mirza A. Baqi Bég and Paul C. DeCelles (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 128: 386-8(Oct. 1, 1962).

It is shown that, if the divergences of the vector currents of the weak interactions satisfy a spectral representation with at most one subtraction, the dominant term in the ratio of θ^+ to θ_1^0 decay rates can be computed without explicit introduction of the electromagnetic field. Furthermore, a wide class of reasonable S-wave $\pi^+\pi^0$ scattering phase shifts can account for the exact θ^+/θ^0 branching ratio. In particular, if one accepts a T = 1, θ^+ ξ meson, the final result is remarkably close to the experimental θ^+/θ^0 ratio. (auth)

31040 $\pi\pi\gamma$ DECAY MODE OF NEUTRAL K MESONS. D. Stern (Univ. of Wisconsin, Madison). Phys. Rev., 128: 389-90(Oct. 1, 1962).

The decay $K \rightarrow \pi^+ + \pi^- + \gamma$, $\gamma \rightarrow e^+ + e^-$ has been observed in the film of the UCRL 72-in. hydrogen bubble chamber exposed to a beam of 1325-Mev/c momentum negative pions. This event unambiguously fits only the decay mode $K \rightarrow \pi + \pi + \gamma$, but because of K's life span is almost exactly one K_1^0 lifetime it is impossible to say whether it is a direct $\pi\pi\gamma$ or inner bremsstrahlung accompanying normal $K_1^0 \rightarrow 2\pi$ decay. (auth)

31041 REMARKS ON THE ELECTROMAGNETIC INTERACTIONS OF MASSLESS PARTICLES. Loyal Durand, III (Yale Univ., New Haven). Phys. Rev., 128: 434-40 (Oct. 1, 1962).

A result recently obtained by Case and Gasiorowicz, that a massless particle of spin $s > \frac{1}{2}$ cannot have the usual type of coupling to the electromagnetic field, is examined from a point of view different from that taken by those authors. It is shown that such a particle may, in fact, have derivative couplings of order $2s + 1$ or $2s - 1$ with the electromagnetic field for s an integer or half-integer, respectively. These couplings cannot be generated by the usual requirement that the equations of motion be invariant under phase transformations, nor can they be present for dimensional reasons in a theory which contains no mass (or characteristic length), these conditions leading to the stated result. However, there is no reason in principle to expect such couplings to be absent if the massless particle interacts also with a charged massive field. An example is given for $s = 1$, and the cross section for Coulomb scattering of a massless particle is given for arbitrary s. (auth)

31042 PIONIC CONTRIBUTIONS TO THE MAGNETIC MOMENT OF THE MUON. Loyal Durand, III (Yale Univ., New Haven). Phys. Rev., 128: 441-8(Oct. 1, 1962).

The anomalous magnetic moment κ of the muon is affected in order α^2 by vacuum polarization corrections to the photon propagator which involve strongly interacting particles. The contributions of the two- and three-pion systems to κ are estimated using the present experimental information on the $J = 1^-$ two-pion and three-pion resonances (the ρ and ω mesons). The analysis is based on the use of dispersion relations for the muon vertex functions, and the Lehmann-Källén representation for the photon propagator. If it is assumed that the ρ-meson resonance gives the dominant contribution to the electromagnetic form factor of the pion, the modifications of the photon propagator associated with the two pion intermediate state lead to a change in κ: $(\Delta\kappa)_{3\pi} \sim (\alpha^2/36\pi)\,(m_\rho^2 - 4m_\pi^2)^{5/2} m_\mu^2 m_\rho^{-4}\Gamma_\rho^{-1}$, where Γ_ρ is the width of the ρ resonance in pion-pion scattering. In the limit of Gell-Mann's unitary symmetry of the meson-baryon interactions, the ω-meson contributions to κ are one-third of the ρ-meson contributions. With $m_\rho = 750$ Mev and the recent Yale value of 60 Mev for Γ_ρ, one obtains a combined result $\Delta\kappa \sim 1.1 \times 10^{-7}$ which is an order of magnitude larger than (1) would be estimated using perturbation theory and (2) the nominal size of the sixth-order electrodynamic corrections; but which is still negligible in comparison with the quoted limits of error of $\pm 5 \times 10^{-6}$ in the best measurement of κ, that of Charpak et al. The possibility of obtaining additional large contributions from $\rho - \pi$ and $\omega - \pi$ configurations in the three- and four-pion states is discussed briefly. (auth)

31043 RESONANCE MODEL FOR PHOTOPRODUCTION OF K MESONS ON NUCLEONS. Shigeo Hatsukade (Univ. of Rochester, N. Y.) and Howard J. Schnitzer. Phys. Rev., 128: 468-77(Oct. 1, 1962). (NYO-10133)

An approximate one-dimensional dispersion relation of the Cini-Fubini type is assumed for the invariant amplitudes of the photoproduction of K mesons on nucleons on the supposition that among the various intermediate states in the three related channels only the single-particle states and the resonant states make appreciable contributions. The resonant states that are taken into account are the following: the three-pion-nucleon resonances, the pion-kaon resonance, and the three pion-hyperon resonances. The expressions for the spectral functions are derived by applying the unitarity conditions to each of the three related channels. By the conservation of angular momentum and parity only certain multipole amplitudes determined by the spin and parity of the resonances contribute to the spectral functions, and for these nonvanishing multipole amplitudes the Breit-Wigner formula is assumed. (auth)

31044 SCATTERING AND PRODUCTION AMPLITUDES WITH UNSTABLE PARTICLES. J. S. Ball (Univ. of California, San Diego, La Jolla), W. R. Frazer, and M. Nauenberg. Phys. Rev., 128: 478-?(Oct. 1, 1962).

An S-matrix theory is developed for a system interacting particles in which unstable particles are included. The particular system considered is $\pi + N \rightarrow \pi + N$, $\pi + N \rightarrow \rho + N$, and $\rho + N \rightarrow \rho + N$. Only the one-pion-exchange interaction is included. The relationship to the strip approximation and the application to the higher resonances in pion-nucleon scattering are discussed. Complex singularities are evaluated, and their relationship to the generalized unitarity condition for the pion-pion system is stressed. An extended ND^{-1} method is used to develop a system of nonsingular, uncoupled, Fredholm integral equations, from which the transition amplitudes can be evaluated. (auth)

31045 THE EXISTENCE OF THE D^+ MESON. L. M. Barkov, K. N. Mukhin, V. V. Ogurtsov, A. S. Romantseva, I. A. Svetlolobov, S. A. Chueva, R. S. Shylapnikov, M. F. Likhachev, V. S. Stavinskii, and L. W. Strunov (Inst. of Atomic Energy and United Inst. of Nuclear Research,

USSR). Zhur. Eksptl'. i Teoret. Fiz., 43: 335-7(July 1962). (In Russian)

The existence of the D^+ meson, which should be an isotopic singlet (S = +2, T = 0), is allowed. This particle can decay by two paths: $D^+ \rightarrow K^+ + \pi^0$, and $D^+ \rightarrow K^0 + \pi^+$. The second path is twice as probable as the first path. The half life of the D^+ meson should be about 10^{-13} seconds (decay proceeds with a $\Delta T = \frac{1}{2}$). The reaction $K^+ + p \rightarrow D^+ + \Sigma^+$ was investigated in order to detect the D^+ meson during its formation and decay in a propane bubble chamber. A beam of positive particles with a momentum of about 1.8 Bev/c, containing up to 9% K^+ mesons was used to irradiate the propane bubble chamber. In all, 14,000 photographs were examined, but not a single case was found, where a D^+ meson was formed. The upper limit for the formation cross section of a D^+ meson by interaction of a K^+ meson with a nucleon is estimated to be $\sigma < 1.2 \times 10^{-29}$ cm^2. (TTT)

31046 DEPOLARIZATION OF THE μ-MESON IN AN ELECTRIC FIELD. Yu. M. Ivanov, B. A. Nikol'skii, B. N. Smirnov, and L. V. Surkova. Zhur. Eksptl'. i Teoret. Fiz., 43: 337-9(July 1962). (In Russian)

Additional depolarization of a μ^+ meson (from a $\pi^+ \rightarrow \mu^+$ decay) was observed in the presence of an electric field with a tension $E \sim 10^5$ V/cm. Hence, it was concluded that the μ^+ meson is captured by a gelatin molecule, since theoretical calculations show that a field of 10^5 V/cm cannot depolarize a μ-meson in the free state or in the state of a muon (the system μ^+e^-). The experiment was carried out by synchronizing the pulses of 85 Mev π^+ mesons with electrical impulses having an amplitude U = 5 kv, which were fed to plane electrodes between which a photoemulsion 200 to 400 μ thick was placed. The electrical field in the emulsion was 1.2 to 2.5×10^5 V/cm. All $\pi \rightarrow \mu \rightarrow e$ disintegrations in the emulsion took place in this strong electric field (the variation in electric field did not exceed 10%). Control experiments were also run in the absence of an electric field in order to exclude the effect of the external magnetic field on the depolarization of the μ-meson. The values of the asymmetry coefficient $\underline{a}$, which determines the angular distribution of electrons in a $\pi \rightarrow \mu \rightarrow e$-disintegration in the equation $dN/d\vartheta \sim 1 - a \cos\vartheta$ were found to be 0.14 with no electric field, 0.08 with an electric field of 1.2×10^5 V/cm, and 0.06 with an electric field of 2.4×10^5 V/cm. This effect can be qualitatively explained, if it is assumed that the μ-meson is captured by a gelatin molecule. (TTT)

31047 THE CHARACTER OF ELASTIC π-N AND OF p-p SCATTERING IN THE REGION OF A LARGE TRANSMITTED MOMENTUM. Yu. D. Bayukov, N. G. Birger, G. A. Leksin, and D. A. Suchkov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 43: 339-41(July 1962). (In Russian)

The differential, elastic scattering cross section for strongly interacting particles at high energies can be described by the expression: $d\sigma_{el}/dt = f(t)\, s^{2[\underline{t}(t)-1]}$. Here $\underline{t}$ is the square of the momentum imparted during scattering, and $\underline{s}$ is the square of the total energy of the scattered particles in the center-of-mass system. The function $\underline{t}(t)$ is the same for any pair of strongly interacting particles. At t = 0 the value of $\underline{t}(0)$ is a maximum equal to one, if σ_t = constant. The probability of transmitting a given momentum decreases with increasing values of $\underline{s}$, and the value of $d\sigma_{el}/dt$ depends strongly on $\underline{s}$ at a high transmitted momentum. The available data on π-N scattering are given for energies of 2 to 20 Bev. In spite of the inaccuracies in the data, the numerical value of $\underline{t}(t)$ was estimated for two-intervals of t. It is desirable to find the value of $\underline{t}(t)$ independently from data on p-p scattering, since theory predicts the universality of the function $\underline{t}(t)$ for the scattering of all strongly-interacting particles. The data of G. Cocconi and that of B. Cork et al. on p-p scattering were used to calculate the value of $\underline{t}(t)$ for six intervals of the value of t. It was found that $\underline{t}(t)$ decreases with increasing $|t|$ and changes sign at $|t| \sim 1$ (Bev/c)^2. In spite of the large experimental error, there is no contradiction between the data on p-p and π-N scattering. (TTT)

31048 THE $\Lambda\eta$-RESONANCE. B. L. Ioffe (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 43: 341-2 (July 1962). (In Russian)

Formation of a η-meson was observed in the reaction $K^- + p \rightarrow \Lambda + \eta$. When the energy E in the center-of-mass system exceeds by 20 Mev the threshold energy for this reaction ($m_\Lambda + m_\eta = 1600$ Mev), the cross section for the formation of an η-meson is $\sigma_\eta = 0.63$ mb, and at $E - (m_\Lambda + m_\eta) = 60$ Mev, the cross section $\sigma_\eta < 0.04$ mb. Hence, it appears that the $\Lambda\eta$ system has a resonance with a mass of about 1680 Mev and a half-width $\Gamma/2 < 10$ Mev. The parity of the resonance state Y should coincide with the parity of η (parity of Λ is taken as +1). The η-meson is either pseudoscalar (state 0^-) or vectorial (1^-). In both cases the parity of the Y-resonance should be negative. The reaction $Y \rightarrow \Sigma + \pi$ should be observed in the $\Sigma + \pi$ system. If the η-meson is pseudoscalar, the π-mesons from the $Y \rightarrow \Sigma + \pi$ will be obtained in the s or p states, depending on whether the parity of Σ coincides with the parity of the Λ particle or is opposite to it. Since Y has a spin $j = \frac{1}{2}$ in this case, these two possibilities cannot be experimentally distinguished by investigating the angular distribution or polarization of the Σ-hyperons. If the η-meson is vectorial, the spin of Y can equal $\frac{1}{2}$ or $\frac{3}{2}$. In the latter case Y-hyperons can be formed, and an anisotropic angular distribution of π-mesons will be observed during decay of the Y-hyperons. (TTT)

31049 THE IONIZATION LOSSES OF ULTRARELATIVISTIC ELECTRONS. G. B. Zhdanov, M. I. Tret'yakova, V. N. Tsytovich, and M. N. Shcherbakova. Zhur. Eksptl'. i Teoret. Fiz., 43: 342-5(July 1962). (In Russian)

Corrections for coulombic scattering in a medium can be improved by taking into account the radiation losses of fast, charged particles which are stopped in a photoemulsion. The radiation correction can be represented in the form $(W - W_0)/W_0 = -(e^2/\pi\hbar c)\,\Delta\,(\epsilon_p/mc^2)$. Here W_0 is the coulombic ionization loss, ϵ_p is the energy, and m is the mass of the fast, charged particle, and $\Delta > 0$ is a monotonically increasing function of the energy which asymptotically approaches saturation ($\Delta = \Delta_\infty$) as $\epsilon_p/mc^2 \rightarrow \infty$. In an actual case we obtain the approximate expression $\Delta_\infty = 2 \ln^2 \xi$, where ξ is a function of the total concentration of electrons in the medium, and of all the particular frequencies of the radiation. In the case of a photoemulsion, the values of ξ^{-1} can be estimated within the limits of 100 to 200 from the values of the ionization potentials of AgBr. It is found that the asymptotic value of the radiation correction, which is attained at $\epsilon_p \gg 100$ to 200 mc^2, should be 8 to 10%. Accurate measurements of the ionization losses of fast secondary electrons were obtained by irradiating a NIKFI-R emulsion with 8.7 Bev protons, and an Illford G-5 emulsion with 19 Bev protons. The relative ionization density of a proton track in the same region of the photoemulsion was used to calibrate the energy of the secondary electron. A radiation loss of the expected sign and amplitude was detected. (TTT)

Neutron Physics

31050 (AECL-1577) SCATTERING LAW FOR UO_2. I. M. Thorson and B. C. Haywood (Atomic Energy of Canada Ltd., Chalk River, Ont.). [1962]. 17p.

Momentum and energy changes of neutrons inelastically scattered by UO_2 at 20°C were measured over the range of energy transfer of 0.007 to 0.09 ev and the range of momentum transfer of $Q = 2(Å)^{-1}$ to $15(Å)^{-1}$ to establish the scattering law and hence the frequency distribution $\rho(\beta)$ of normal vibrational modes of the UO_2 lattice. The results are presented in the $S(\alpha,\beta)$ notation. Extrapolation of S/α vs α to $\alpha = 0$ gives the value of $\rho(\beta)$. (auth)

31051 (AECL-1578) SCATTERING OF NEUTRONS BY LIQUID BROMINE. G. E. Coote and B. C. Haywood (Atomic Energy of Canada Ltd., Chalk River, Ont.). [1962]. 11p.

Neutrons of 0.037 and 0.0088 ev were scattered from a thin sample of liquid bromine at room temperature, and the energy distributions of the scattered neutrons measured at angles from 10 to 160° by the time-of-flight method. The angular distribution was also measured. Spectra were expressed in the form of the scattering law $S(\alpha,\beta)$ and analyzed to derive the generalized frequency distribution $p(\beta)$ of atomic motions in the liquid. The function $p(\beta)$ has a broad smooth peak centered at $\beta \approx 0.3$, and shows no evidence for discrete levels in the measured range $0 < \beta < 0.8$; the general shape of the curve supports the quasi-crystalline picture of the liquid. Difficulty in the absolute normalization of $p(\beta)$ is discussed. (auth)

31052 (GA-3176) STATUS OF NEUTRON SPECTRA MEASUREMENTS. J. R. Beyster, J. C. Young, G. D. Trimble, D. H. Houston, and Y. D. Naliboff (General Atomic Div., General Dynamics Corp., San Diego, Calif.). May 1, 1962. Contract AT(04-3)-167. 51p.

The status of differential neutron spectra (experiment and theory) is discussed and existing discrepancies whether of new or old origin are pointed out. The emphasis of the discussions is mainly on results and potentialities of direct spectral measurement techniques. A brief discussion is included on foil activation procedures. (J.R.D.)

31053 (GA-3371) NEUTRON INTERACTIONS IN LIQUID PARA- AND ORTHO-HYDROGEN. W. L. Whittemore and H. R. Danner (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Aug. 8, 1962. Contract AT(04-3)-167. 25p.

An experimental method is described which utilizes a simple Fermi-type chopper and conventional time-of-flight techniques in conjunction with an electron linear-accelerator pulsed neutron source to study inelastic scattering of thermal neutrons from liquid para- and ortho-para-hydrogen. The overall general agreement between theory and experiment supports the concept that the molecules in liquid hydrogen behave nearly as they would in a perfect gas. For liquid ortho-para-hydrogen, however, the extra broadening of the energy distribution of scattered neutrons suggests that some effects of the liquid state may be present. Similar observations on para-hydrogen indicate that, in this liquid as well, the motion of the molecules is affected by weak intermolecular forces. (auth)

31054 (HW-SA-2541) THE SCATTERING LAW FOR ROOM TEMPERATURE LIGHT WATER. D. A. Kottwitz and B. R. Leonard, Jr. (General Electric Co. Hanford Atomic Products Operations, Richland, Wash.). [Aug. 8, 1962]. Contract AT(45-1)-1350. 27p.

The Hanford triple-axis crystal spectrometer was used to measure the Egelstaff scattering law for light water at 22°C for neutron wave vector changes up to 14 $Å^{-1}$ and energy transfers in the range 0.05 to 0.25 ev. The values of initial neutron energy were 0.15, 0.20, 0.30, and 0.40 ev, and scattering angles ranged from 4° to 72°. Scattering by a vanadium sample at 77°K served to establish the spectrometer resolution and efficiency functions. The scattering law $S(\alpha,\beta)$ and the generalized frequency distribution $p(\beta)$ derived from it are in substantial agreement in the overlap region with results obtained by Haywood and Thorson. The function $p(\beta)$ was extended to $\beta \approx 10$ to include the region occupied by the lowest molecular vibration level near $\beta = 8$. In this region the measured $p(\beta)$ has a low sloping plateau, indicating that the vibrational peak was smeared out by broad instrumental resolution. The normalization integral of the measured $p(\beta)$ is higher than its theoretical value. (auth)

31055 (HW-SA-2542) QUASI-ELASTIC SCATTERING BY ROOM TEMPERATURE LIGHT WATER. D. A. Kottwitz, B. R. Leonard, Jr., and R. B. Smith (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Aug. 8, 1962]. Contract AT(45-1)-1350. 16p.

The energy width and integrated intensity of the quasi-elastic scattering peak of light water at 22°C were measured on the Hanford triple-axis crystal spectrometer at scattering angles for 0.10, 0.15, and 0.25 ev neutrons. The energy resolution was 7, 11, and 10%, respectively. Wave-vector transfers ranged from 1 to 7 $Å^{-1}$. The quasi-elastic peak was assumed to have a Lorentzian shape in correcting the observed peaks for resolution. When plotted vs the square of the wave-vector transfer, both the corrected line width and integrated intensity exhibit systematic differences correlated with the energy of the neutrons used. In general, the present widths are greater than those obtained with cold and thermal neutrons. Neither the simple classical model nor the Singwi-Sjölander model for self-diffusion in water gives completely satisfactory agreement with the present results. (auth)

31056 (LADC-5381) THE DETERMINATION OF THERMAL NEUTRON DENSITY FROM THE ABSOLUTE MEASUREMENT OF THE ACTIVITY INDUCED IN GOLD FOILS (thesis). Munson M. Thorpe (Los Alamos Scientific Lab., N. Mex.). May 1962. Contract [W-7405-Eng-36]. 59p.

The interaction of thermal neutrons with a coin shaped detector is discussed in terms of the reaction rate in an infinite sheet of pure absorber irradiated in a void by an isotropic, Maxwell distribution of thermal neutrons. A coincidence method for the evaluation of the decay rate of the neutron induced activity in gold is examined in detail and utilized to measure the relative specific activity of gold foils exposed to neutrons in the graphite thermal column of the Water Boiler Reactor. The relative specific activity was obtained for ¾- and ¼-in. diameter foils as a function of thickness for values of the thickness from 1.5 mg/cm^2 to a nominal thickness of 0.010 in. From the activity of the thinnest foils, the neutron density in the thermal column was obtained relative to the reactor power and the counting rate of a parallel plate fission chamber. (auth)

31057 (UCRL-6264) NEUTRON ENERGY MEASUREMENTS BY AN ATTENUATION TECHNIQUE. Seymour Block and Frederick J. Shon (California. Univ., Livermore. Lawrence Radiation Lab.). Dec. 1960. Contract W-7405-eng-48. 16p.

A technique was developed for finding the average energy of stray neutron radiation. Neutron energies can be measured by applying the fact that the spatial variation of

a thermal flux formed in a moderating material is quite strongly a function of the fast flux energy distribution. An attenuation curve was plotted using polyethylene discs as neutron absorbers and a BF_3 counter as the detector. Calibration curves of relaxation length vs energy, equilibrium thickness vs energy, and counts/minute per unit neutron flux vs energy were plotted. (auth)

31058 (UCRL-6912) SOPHIST II—A GROUP CROSS SECTION IBM 700/7090 CODE. Eugene H. Canfield and Joseph Pettibone (California. Univ., Livermore. Lawrence Radiation Lab.). May 21, 1962. Contract W-7405-eng-48. 17p.

SOPHIST II is an IBM 709/7090 code, compatible with Monitor, which calculates temperature-dependent flux-weighted group cross sections for use in multigroup neutronic calculations. The moderator model is a Maxwell gas. The input flux spectrum is specified analytically and/or pointwise. The input cross-section data can be analytic 1/v, a series of single-level Breit Wigner resonances, pointwise, and/or a pointwise deviation from 1/v. An optional feature allows for self-shielding in absorbing foils. The code allows 90 energy groups, 131 pointwise fluxes, 100 resonances, and 400 (minus the number of resonances) pointwise cross sections. (auth)

31059 TRAPPING OF THERMAL NEUTRONS. I. CRITERIA OF HIGHLY TRAPPING MEDIA. Masuhiko Otsuka (Electric Power Development Co., Ltd., [Japan]). Nippon Genshiryoku Gakkaishi, 4: 423-30(July 1962). (In English)

A comparative study of trapping media is made by an analytical approach in order to derive criteria of highly trapping media. Spherical and cylindrical media are analyzed in the two-group diffusion theory. A criterion is that the thermal neutron diffusion coefficient of a trapping medium must be much smaller than both the slowing-down length and the thermal neutron diffusion length, provided that both lengths should be modified in case of a finite cylinder. Small flux-trapping reactors can be realized by a medium whose characteristic lengths are both short. Calculated values of the trapping effectiveness and the optimum radius of ordinary moderators are given. Although comparison with experiments is not possible, it is suggested that the trapped thermal neutron flux definitely cannot be larger than the flux at the periphery of a trapping medium by a factor of ten. (auth)

31060 THE THERMAL NEUTRON RESPONSES OF FILM AND SILVER-ACTIVATED PHOSPHATE GLASS AND THEIR MEASUREMENT OF COMBINED THERMAL NEUTRON AND GAMMA RADIATION. Ichiro Miyanaga, Minesumi Yamamoto and Kazuyoshi Bingo (Japan Atomic Energy Research Inst., Tokyo. Nippon Genshiryoku Gakkaishi, 4: 431-5(July 1962). (In English)

The thermal neutron responses of a film and a silver-activated phosphate glass containing Li, Al, B, and Ag were measured. The thermal neutron responses of film and glass were $(3.84 \pm 0.77) \times 10^{-10}$ and $(4.14 \pm 0.46) \times 10^{-9}$ rad/n/cm^2 respectively. The capture γ-ray emission of 1 mm Cd was determined to be $(1.50 \pm 0.30) \times 10^{-9}$ and $(1.62 \pm 0.17) \times 10^{-9}$ rad/n/cm^2 by film and glass measurements respectively, and agreed with the calculated value of 1.2×10^{-9} rad/n/cm^2 as the lower limit. The described method could be used for the determination of thermal-neutron and γ-ray doses in mixed radiation fields. (auth)

31061 THE DIFFUSION PROCESS OF NEUTRONS SCATTERED ANISOTROPICALLY. I. AGE THEORY. Reikichi Nozawa (Tokyo Inst. of Tech.). Nippon Genshiryoku Gakkaishi, 4: 440-7(July 1962). (In Japanese)

The diffusion process of neutrons scattered anisotropically in the laboratory system is studied stochastically, using the Markov method. A recurrence formula is derived for the characteristic function that should describe the population of neutrons around a source. The problem is reduced to that of obtaining the maximum eigenvalue (and its associated eigenfunction) of an integral equation with real symmetric kernel, and is solved asymptotically for aged neutrons. It is suggested that the Fermi age should be replaced by the "collision" age. (auth)

31062 MATHEMATICAL PROBLEMS FOR ONE-DIMENSIONAL THEORY OF PARTICLE TRANSPORT. V. S. Vladimirov. Trudy Mat. Inst., Akad. Nauk SSSR, No. 56, 1-158(1961). (In Russian)

Kinetic equations (transport equations) describing neutron transport are developed, and the data obtained are interpreted for reactor calculations. An attempt was made to develop a precise mathematical theory for transport using as an example a stationary one-dimensional equation. A supplement is included on functional analysis and theory of functions. (R.V.J.)

Nuclear Properties and Reactions

31063 (IDO-16797) RADIOCHEMICALLY DETERMINED RATIOS OF ASYMMETRIC TO SYMMETRIC FISSION OF U^{233}, Pu^{239}, AND U^{235} AS A FUNCTION OF NEUTRON ENERGY. W. H. Burgus (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). July 30, 1962. Contract AT(10-1)-205. 25p.

Results of studies concerning the asymmetric/symmetric ratio for fission induced by neutrons of energies corresponding to various fission resonances are presented. These studies were carried out primarily with monoenergetic neutrons at 1.8, 2.3, and 4.3 ev. The fission ratios in the low-energy resonance region was found to change from resonance to resonance, and the ratios appear to fall into symmetry classes each of which has a characteristic peak-to-valley mass yield ratio. It appears that a spin dependence is involved in the mass distribution as predicted by the Bohr model. The exact nature of this dependence is not clearly understood. (J.R.D.)

31064 (IS-252) SMALL ORDER SHAPE FACTOR IN Na^{22}. R. T. Nichols, R. E. McAdams, and E. N. Jensen (Ames Lab., Ames, Iowa). [Jan. 11, 1961]. Contract [W-7405-eng-82]. 16p.

The beta spectrum of Na^{22} was examined using an intermediate-image beta spectrometer operating at 2½% transmission and 2.4% resolution. Five separate determinations of the maximum energy and of the slope of the form-factor plot were made. One determination was made using a charge-discriminating baffle inserted in the spectrometer. The unweighted mean of the five values for the maximum energy is 547.4 ± 1.0 kev. The unweighted mean of the five values for the form-factor slope is 0.023 ± 0.006 l/mc^2. (auth)

31065 (IS-238) PHOTOPRODUCTION OF BERYLLIUM-7. M. S. Foster and A. F. Voigt (Ames Lab., Ames, Iowa). [Dec. 5, 1960]. Contract [W-7405-eng-82]. 14p.

The nuclide Be^7 was produced by photoactivation of Be^9, B, and C^{12} using the bremsstrahlung beam of an electron synchrotron operated at 45 Mev. Integrated cross sections for the formation of Be^7 were estimated by comparison with the $Ta^{181}(\gamma,n)Ta^{180m}$ reaction. The reaction $C^{12}(\gamma,2p3n)Be^7$ was also observed in irradiations at 30, 35, and 40 Mev maximum energy. Its yield was compared with that of the

$C^{12}(\gamma,n)$ reaction at 45 Mev. The reaction $Al^{27}(\gamma,2p3n)Na^{22}$ was observed at 45 Mev. (auth)

31066 (NP-11746) SISTEMÁTICA DE LAS TRANSICIONES ISOMÉRICAS DEL TIPO E_2 EN NUCLEÍDOS DE A IMPAR. INFORME NO. 59. (Systematics of the Isomeric Transitions of the Type E_2 in Odd A Nuclei. Report No. 59). S. J. Nassiff and A. Mocoroa (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires and Argentina. Universidad Nacional de la Plata). 1961. 15p.

The existing experimental data on isomeric transitions of E_2 character, whose disintegration periods are well known, are systematized. The data are compared with results predicted by the independent-particle model. (tr-auth)

31067 (NYO-9536) APPLICATION OF THE PROJECTION THEOREM TO NUCLEI WITH LOW MASS NUMBER. S. Iwao, F. B. Wang, and S. Morin (Rochester, N. Y. Univ.). Jan. 17, 1961. Contract AT(30-1)-875. 13p.

Results of the application of the projection theorem to nuclei of low mass number are summarized. Nuclei of $s_{\frac{1}{2}}$-shell, $p_{\frac{3}{2}}$-shell, and $p_{\frac{1}{2}}$-shell are discussed. The parameters obtained from the binding energies do not explain the observed energy levels well, but the general feature of the parameters is consistent in both cases. Applicability of the theorem is tested independently by using the transformation between the observed level schemes of different nuclei; these results give a better explanation than those found by using the parameters obtained from binding energies. (auth)

31068 (PUC-1962-77) THE MECHANISM AND THE RELATIVE MAGNITUDES OF DOUBLE STRIPPING AND PICKUP REACTIONS. C. F. Clement (Princeton Univ., N. J. Palmer Physical Lab. and United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). June 29, 1962. 6p. Contract [AT(30-1)-937].

Two experimental methods are discussed which test the approximations leading to the selection rules in He^3 and triton double stripping and pickup reactions. The ratios, obtained from experiment, of the two orbital angular momentum transfer components in some p shell reactions are compared with theoretical predictions. (auth)

31069 (TID-11967) NEUTRON CAPTURE CROSS-SECTION OF 36 HR Rh^{106}. J. G. Cuninghame, L. E. Glendenin, and A. L. Harkness (Argonne National Lab., Ill.). Nov. 1960. Contract [W-31-109-eng-38]. 2p. (UAC-4740)

Results of experiments aimed at measuring the thermal fission yields of Pu^{239} indicated a large neutron capture cross section for 36-hr Rh^{106} in the fission decay chain. An estimate was made using the value 3×10^{14} n/cm^2/sec for the flux. The (n,γ) cross section of Rh^{105} was found to be $\geq 1.8 \times 10^4$ barns. (J.R.D.)

31070 (TID-12043) SPIN-ORBIT SPLITTING AND PION THEORETIC L-S POTENTIAL. Akito Arima, Masao Sugawara (Argonne National Lab., Ill.); and Tukuo Terasawa (Japan Atomic Energy Research Inst., Tokyo). Sept. 1960. Contract [W-31-109-eng-38]. 9p. (UAC-4546)

It was found that the pion-theoretic L-S potential can give large fractions in such a way that the over-all effects just explain observed doublet splittings in nuclei without changing nuclear radii. Doublet splittings in He^5, N^{15}, and O^{17} are explained in terms of the combination of the second-order effect due to the tensor force and the first-order effect due to the L-S potential. (M.C.G.)

31071 (TID-16437) LANTHANUM ISOTOPES IN A POSSIBLE NEW REGION OF NUCLEAR DEFORMATION. Ivor L. Preiss, Paul M. Strudler, and Richard Wolfgang (Yale Univ., New Haven). [Aug. 13, 1962]. Contract [AT (30-1)-2726]. 11p.

The discovery and further characterization of several neutron deficient lanthanum isotopes are reported. These isotopes occur in what was previously postulated as a possible new region of nuclear deformation. Heavy ion bombardments of natural indium foil were used to produce the neutron deficient La isotopes by means of $In(O^{18},xn)La$ reactions. Two procedures were then used: direct observation of the decay of La separated chemically from irradiated targets and chemical milking of Ba daughter activities. Assignments for La^{127} and La^{128} were straightforward. La^{126} and La^{129} have Ba daughters sufficiently similar in half life to make their resolution difficult. (M.C.G.)

31072 (TID-16473) TRANSITION MATRIX FOR NUCLEON-NUCLEON SCATTERING. [PART] II. K. L. Kowalski and D. Feldman (Brown Univ., Providence). [Aug. 15, 1962]. Contract AT(30-1)-2262. 40p.

The Fredholm reduction of the singular integral equation satisfied by the reactance matrix which was developed in a previous paper is extended so as to constitute a complete and unified Fredholm formalism for the various integral equations which occur in the momentum-space formulation of two-body (potential) scattering problems. The essential simplification which permits this unified treatment is the demonstration of the formal similarity of the scattering integral equations, whether part of the interaction includes a hard core or not. The principal result consists in an apparatus which is useful in performing those two-body calculations which occur in investigations of high-energy nucleon-nucleus scattering; in particular, the technique is used to obtain the solutions of integral equations satisfied by transition matrices which appear typically in multiple-scattering theories. The relation between the uniqueness of solutions of the scattering integral equations and the validity of the Fredholm formalism is also discussed. Methods which were previously considered for obtaining approximate solutions of the Fredholm equations are generalized. (auth)

31073 (UCRL-9266) TRANSITION PROBABILITIES FOR LOW LYING ELECTRONIC STATES IN C_2. Enrico Clementi (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Dept. of Chemistry). Mar. 25, 1960. Contract W-7405-eng-48. 18p.

The probabilities for nine electronic transitions among the low lying excited states in the C_2 molecule were calculated by the dipole moment operator method and are given in the form of oscillator strength (or f values). The amount of hybridization in the $2\sigma_u$ and $3\sigma_u$ molecular orbitals were calculated with a semi-empirical method closely related to the Mulliken formula. The agreement between the coefficient of hybridization thus obtained and those obtained with more refined calculations is satisfactory for the $1_{\Sigma_g^+}(a)$ ground state (the only state that could be compared). The f values for the Swan, Deslandres-d'Azambuja, Mulliken, Fox-Herzberg, Phillips, and Ballik-Ramsay transitions were calculated as f = 0.048 (experimental 0.034), f = 0.0650, f = 0.1025, f = 0.8184, f = 0.0027, and f . 0.0066, respectively. The f values for three additional yet unknown transitions between low lying states are also reported. (auth)

31074 (UCRL-10334) THE NUCLEAR SPINS AND MAGNETIC MOMENTS OF Ag^{112}, Ag^{113}, Au^{194}, Au^{196}, Au^{198}, AND Au^{198m} (thesis). Yau Wa Chan (California. Univ.,

Berkeley. Lawrence Radiation Lab.). June 27, 1962. Contract W-7405-eng-48. 143p.

An atomic-beam magnetic-resonance apparatus of the flop-in type was used to measure the nuclear spins and hyperfine-structure separations of the $^2S_{\frac{1}{2}}$ electronic ground state for several radioactive isotopes of silver and gold. The results, together with calculated values of the nuclear magnetic-dipole moemnts, are given. All isotopes were produced by cyclotron bombardment. Resonance detection was accomplished by collecting the radioactive atoms on a sulfur-coated surface. The activity on the surface due to Ag^{112}, Ag^{113}, and Au^{196m} was counted in continuous-flow methane counters; whereas, the activity due to Au^{194}, Au^{195}, and Au^{196} was counted in low-background scintillation crystal counters. The Fermi-Segrè formula was used to calculate the nuclear magnetic moment from the measured hyperfine structure separation $\Delta\nu$ with values of $\Delta\nu$ and μ_I previously measured directly for stable isotopes of the same element. A technique of multiple-quantum transitions was used for measurements on Au^{196}, since the $\Delta\nu$ of Au^{196} is so large that the standard transition could not be observed with the atomic-beam apparatus. (auth)

31075 (CEA-tr-A-1154) CONTRIBUTION Â LA THÉORIE DU SUPERMULTIPLET DE WIGNER. (The Theory of Wigner Supermultiplets). Martin Kretzschmar. Translated into French by P. Monnard from Z. Physik, 157: 558-67(1960). 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 8236.

31076 ANGULAR DISTRIBUTION OF PROTONS FROM THE REACTION $N^{14}(d,p)N^{15}$. D. Stanojević and M. Jurić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13, No. 2, 1-5(July 1962). (In English)

The angular distribution of long-range protons from the reaction $N^{14}(d,p)N^{15}$ was measured by bombarding a nitrogen target with deuterons at 0.75, 0.95, 1.03, and 1.10 Mev. The coefficients of Legendre polynomials, as well as the theoretical angular distribution curves for $l_a = 1$, were calculated. (auth)

31077 LEVEL SCHEME OF ^{192}Os. L. G. Marinkov and M. T. Župančić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13, No. 2, 7-16(July 1962). (In English)

The intensities of photon and conversion lines were measured, K-conversion coefficients for gamma rays of 201, 205, 283, 375, 484, and 489 kev were determined. The existence of gamma rays of 110 and 489 kev was proved. (auth)

31078 HARD GAMMA RADIATION IN THE DECAY OF Lu^{176m}. I. Řezanka (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Řež), J. Frána, A. Maštalka, and J. Beneš. Czechoslov. J. Phys., 12: 530-3(1962). (In English)

Gamma lines at 1.05 Mev (4×10^{-6} quanta/decay) and 1.14 Mev (9×10^{-6} quanta/decay), giving evidence of the existence of a level in Hf^{176} with an energy of 1.14 Mev, are found in the decay of Lu^{176m} (half life 3.7 hours), using the scintillation method. The component of the beta spectrum exciting this level has a maximum energy of 0.17 Mev and log ft = 8.3. The level is interpreted as a single-particle neutron level with $n_0: \frac{5}{2}^-$ (512), $n_1: \frac{7}{2}^-$ (514); $I = 1^+$. (auth)

31079 THE EFFECT OF PAIRED CORRELATIONS OF A SUPERCONDUCTING TYPE ON THE RATE OF α-DECAY. V. G. Solov'ev (United Inst. of Nuclear Studies, USSR). Doklady Akad. Nauk S.S.S.R., 144: 1281-4(June 1962). (In Russian)

Paired correlations of nucleons of the superconducting type play an important role in nuclear β and γ transitions, and should also be important in α decay. A theory of α decay was formulated within the framework of a superfluid model of the nucleus, and the effect of paired correlations of the superconducting type on the absolute probability of α decay, and especially, on the forbiddenness F was investigated. Calculated values of the forbiddenness F are in satisfactory agreement with the experimental values for the following, allowed α transitions of odd nuclei: $Cf^{249} \rightarrow Cm^{245}$, $Cm^{245} \rightarrow Pu^{241}$, $Cm^{243} \rightarrow Pu^{239}$, $Cm^{241} \rightarrow Pu^{237}$, $Pu^{239} \rightarrow U^{235}$, $Bk^{245} \rightarrow Am^{241}$, $Am^{243} \rightarrow Np^{239}$, $Am^{241} \rightarrow Np^{237}$, $Am^{239} \rightarrow Np^{235}$, and $Np^{237} \rightarrow Pa^{233}$. It is assumed that the quasi-particle is at the same level in the parent and daughter nuclei for an allowed α transition. In the case of a forbidden α transition of an odd nucleus, the α particle is formed from a number of proton pairs lying at levels close to the Fermi surface, and from neutrons in two different states f_1 and f_2. Hence, a forbidden α transition is much more improbable as compared to an allowed transition. A forbidden α transition to an excited state is more improbable than a transition to a hole state. Pair correlations are responsible for only a part of the decrease in the probability of an α transition. Part of the decrease in the probability of an α transition can be explained by a decrease in the formation of an α particle from nucleons which are at different levels. If pair correlations are taken into account, the agreement between theory and experiment is improved. (TTT)

31080 THE DERIVATION OF A SELF-CONSISTENT FIELD IN THE SUPERFLUID MODEL OF THE NUCLEUS. A. Pavlikovskii (United Inst. of Nuclear Studies, USSR). Doklady Akad. Nauk S.S.S.R., 145: 555-6(July 21, 1962). (In Russian)

A system of N fermions can be described by the Hamiltonian $H = \Sigma_i \epsilon_i a_i^+ a_i + \Sigma_{ijkl} V_{ijkl} a_i^+ a_j^+ a_k a_p$ where a_i^+ and a_i are operators for the degeneracy and neutralization of fermions in the single-particle state $|i>$. The second term of this Hamiltonian contains, generally speaking, a certain self-consistent field which is explicitly derived. This procedure is applied to the Hamiltonian of a system of N nucleons with pair interaction. The second sum in H_2 must be summed over the levels containing two nucleons. The constant C is equal to pG, where p is the number pairs of nucleons with quantum numbers s^+ and s^-, and $G > 0$. Many properties of even-even nuclei can be explained by a model of independent particles with pair interaction. The single-particle energy levels are calculated from the experimental data for neighboring odd nuclei, and are considered as levels in a completely self-consistent field. Hence, this problem should be solved by the Hamiltonian given above, where the energy levels E_i are given, and where a self-consistent field is derived from the interaction. (TTT)

31081 STUDY OF THE $Si^{28}(n,\alpha)$ REACTION AND EXPERIMENTAL EVIDENCE OF THE ERICSON FLUCTUATIONS. L. Colli (CISE, Milan and Università, Milan), U. Facchini, I. Iori, M. G. Marcazzan, M. Milazzo, E. Saetta Menichella, and F. Tonolini. Energia nuclear (Milan), 9: 439-50(Aug. 1962). (In English)

The cross sections of $Si^{28}(n,\alpha)Mg^{25}$ reaction for the transition to the ground state and to the first excited states of the residual nucleus Mg^{25} were measured as a function of neutron energy. The measurement was done in the neutron energy range 12.5 to 18.5 Mev with a beam resolution of about 100 kev; a solid state semiconductor Si detector was used. The results of the measurements were analyzed with the theory of the compound nucleus recently developed by T. Ericson. Also the reactions $Al^{27}(p,\alpha)$ and $Si^{28}(d,\alpha)$ at

excitation energy such as to be in the region of overlapped levels were analyzed. (auth)

31082 EXCITATION FUNCTIONS OF $Ni^{58}(n,p)Co^{58}$ AND $Zn^{64}(n,p)Cu^{64}$ REACTIONS IN THE ENERGY REGION FROM 1.8 TO 4.8 Mev. Kozi Nakai, Hiroshi Gotoh, and Hiroshi Amano (Japan Atomic Energy Research Inst., Tokyo). J. Phys. Soc. Japan, 17: 1215-23(Aug. 1962). (In English)

The cross sections of $Ni^{58}(n,p)Co^{58}$ and $Zn^{64}(n,p)Cu^{64}$ reactions are measured by the activation method for neutron energies from 1.8 to 4.8 Mev. The cross sections increase monotonically with neutron energy and at 4.8 Mev their values are 410 ± 60 and 125 ± 25 mb respectively. These results are compared with theoretical calculations performed using an evaporation model with a semi-empirical level density. The experimental values agree with the theoretical ones in the case of $Zn^{64}(n,p)Cu^{64}$ and within a factor of two in the case of $Ni^{58}(n,p)Co^{58}$. (auth)

31083 SPIN-ORBIT SPLITTING IN DEFORMED NUCLEI. Kasuke Takahashi (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1229-44(Aug. 1962). (In English)

Radiation characters of three deformed odd-mass nuclei, viz., Gd^{159}, Tb^{163}, and Dy^{155} were investigated by using conventional beta and gamma ray scintillation spectrometers with a fast-slow coincidence circuit, and decay schemes were discussed in terms of the Nilsson model. On the basis of the experimental results obtained together with those on other deformed nuclei, systematics of energy splittings between states were deduced. (auth)

31084 DIFFERENTIAL EXCITATION FUNCTIONS FOR ALPHA-PARTICLE AND PROTON GROUPS FROM THE DEUTERON INDUCED REACTIONS ON F^{19}. Takashi Maki, Takao Nakashima, Tetsuji Chô, Norihisa Katô, Toshimaro Yamanouchi, and Toshiyuki Ishimatsu (Kyusyu Univ., Fukuoka). J. Phys. Soc. Japan, 17: 1319-20(Aug. 1962). (In English)

The reactions $F^{19}(d,p)F^{20}$ and $F^{19}(d,\alpha)O^{17}$, leading to the ground state of F^{20} and the ground and first excited states of O^{17}, are studied at deuteron energies of 1.2 to 3.2 Mev. The differential excitation functions for the ground-state protons show, at various scattering angles, broad resonances at deuteron energies around 1.7 and 2.1 Mev. The alpha-particle differential excitation functions also have strong resonance-like structures. (T.F.H.)

31085 DETECTION OF SHORT-LIVED MOLYBDENUM FISSION ISOTOPES AND DECAY OF THEIR TECHNETIUM DAUGHTERS. I. DECAY SERIES $Mo^{104} - Tc^{104}$. P. Kienle (Technische Hochschule, Munich), B. Weckermann, F. Baumgaertner, and U. Zahn. Naturwissenschaften, 49: 294-5(1962). (In German)

It has recently been shown that the Cr in $Cr(CO)_6$ can be replaced by the Mo produced in U fission and that the Mo alone of the fission products forms a stable hexacarbonyl. It is shown that from the heterogeneous irradiated mixture, the fission-produced Mo can be sublimated 30 sec after irradiation as $Mo(CO)_6$ with $Cr(CO)_6$ as the carrier without contamination of other fission products. The Tc produced in the sublimate cannot be sublimated. It remains after a second sublimation as a carrier-free residue. The Tc daughter was identified by half-life measurements, γ spectrum, and the Ru decay products. Results of the studies made on the decay series $Mo^{104} \rightarrow Tc^{104} \rightarrow Ru^{104}$ using these methods are reported. Beta decay measurements on the residue of the second sublimate gave a half life of 18 min. The γ spectrum showed prominent lines at 890, 530, 360, and 307 kev. The 890 and 360 kev lines were assigned to the decay to the ground level of Ru^{104}. The measurement of the Tc^{104} to the Tc^{101} activity as a function of time gave a value of 1.1 ± 0.1 min for the half life of Mo^{104}. (J.S.R.)

31086 DETECTION OF SHORT-LIVED MOLYBDENUM FISSION ISOTOPES AND DECAY OF THEIR TECHNETIUM DAUGHTERS. II. THE DECAY SERIES $Mo^{105} - Tc^{105} - Ru^{105}$. P. Kienle (Technische Hochschule, Munich), B. Weckermann, F. Baumgaertner, and U. Zahn. Naturwissenschaften, 49: 295-6(1962). (In German)

From a neutron-irradiated mixture of pure $Cr(CO)_6$ and uranyl acetate, the pure fission Mo was sublimated as $Mo(CO)_6$ 30 sec after irradiation. Five minutes later a second sublimation left the unsublimable Tc daughter as a residue. In addition to Tc^{104}, Tc^{105} was also identified. Beta decay measurements of the residue showed a significant genetic relationship between an activity with a 7.7 min half life and the activity of Ru^{105}. The 7.7 min activity was assigned to Tc^{105}. The half life of Mo^{105} was measured at 40 sec in agreement with earlier results. (J.S.R.)

31087 THE SCATTERING OF ALPHA PARTICLES FROM C^{12}. C. Miller Jones, G. C. Phillips, R. W. Harris, and E. H. Beckner (Rice Univ., Houston, Tex.). Nuclear Phys., 37: 1-22(Aug. 1962). (In English)

The elastic scattering of alpha particles from C^{12} is experimentally studied in the energy range 2.5 to 4.8 Mev using a precision, small-volume, gas scattering chamber. Excitation functions are measured at the center-of-mass (c.m.s.) angles 70° 7′, 90° 0′, 99° 15′, 109° 54′, 125° 16′, 140° 16′, 149° 27′, and 166° 35′, and angular distributions are measured at 2.820, 3.377, 3.989, and 4.640 Mev. These data are parameterized in terms of nuclear scattering phase shifts and the phase shifts have been analyzed using the single level dispersion theory. Three states in O^{16} are observed: a 1^- state at 9.552 Mev, a 2^+ state at 9.815 Mev, and a 4^+ state at 10.329 Mev. These states are found to have c.m.s. reduced widths of 608, 1.07, and 195 kev respectively, with corresponding ratios to the Wigner limit of 85, 0.15, and 27%. (auth)

31088 GAMMA-RADIATION FROM THE MEDIUM ENERGY PROTON BOMBARDMENT OF SODIUM, MAGNESIUM, ALUMINUM, SILICON, PHOSPHORUS AND SULPHUR. K. J. Foley, A. B. Clegg, and G. L. Salmon (Clarendon Lab., Oxford). Nuclear Phys., 37: 23-44(Aug. 1962). (In English)

Measurements are presented of the gamma radiation from the residual nuclei produced by 150-Mev protons on sodium, magnesium, aluminum, silicon, phosphorus, and sulphur nuclei. It is found that only a small number of gamma-rays are produced strongly. This is explained as being caused by the importance of comparatively simple direct reactions at this energy, combined with the way the energy level schemes of these nuclei can be understood as energy level schemes of distorted nuclei, an application of the unified model. It is shown that inelastic scattering cross sections are determined by the same matrix elements as the corresponding radiative transitions, so that only a small number of states are excited strongly by inelastic scattering in these nuclei. The (p,2p) and (p,pn) reactions produce the parent states of the struck ground state. It is shown that, in the unified model, the parentage of the ground state of a distorted 4n-nucleus collects into a very few states of the parent $(4n-1)$-nucleus, in agreement with experimental results. The gamma rays also show the apparent importance of interactions of the incident proton with clusters in the target nucleus. In particular the importance of the (p,pt) reaction on bombarding $(4n-1)$-nuclei and of the (p,pα) reaction on bombarding 4n-nuclei is noted, both these reactions leaving the residual nucleus in its ground state rotational band. (auth)

31089 DECAY OF ^{89}Sr. W. V. Prestwich, K. Fritze, and T. J. Kennett (McMaster Univ., Hamilton, Ont.). Nuclear Phys., 37: 45-56(Aug. 1962). (In English)

The decay features of 7.5-min Sr^{89} are studied with beta- and gamma-ray scintillation spectrometers. The energies and relative intensities of the gamma rays are 0.178 (0.17), 0.210 (0.06), 0.255 (0.13), 0.357 (0.07), 0.396 (0.05), 0.453 (0.09), 0.534 (0.07), 0.597 (1.00), 0.715 (0.35), 0.885 (0.73), 1.01 (0.05), 1.08 (0.09), 1.18 (0.05), 1.26 (0.19), 1.55 (0.04), 1.66 (0.16), 1.74 (0.04), 2.01 (0.02), 2.12 (0.02), 2.19 (0.04), 2.29 (0.04), 2.45 (0.06), 2.58 (0.05), and 3.0 (weak) Mev. The underlined energies indicate that the existence of these gamma rays is not adequately established. The spectrum of gamma rays in coincidence with gating energies of 0.178, 0.597, 0.715, 0.885, and 1.66 Mev is obtained. Beta groups with end-point energies of 4.8, 4.2, 3.9, 3.8, 3.5, 3.3, and 3.0 Mev are observed using a plastic scintillator. From the decay properties obtained a decay scheme is constructed with energy levels at 0.597, 0.775, 0.885, 1.16, 1.32, 1.55, 1.89, 2.29, 2.58, 2.8, and 3.0 Mev. (auth)

31090 FORMATION CROSS SECTIONS FOR Ca^{47} USING 14.5 Mev NEUTRONS. Manny Hillman (Brookhaven National Lab., Upton, N. Y.). Nuclear Phys., 37: 78-82 (Aug. 1962). (In English)

The cross sections of the $Ti^{50}(n,\alpha)Ca^{47}$ and $Ca^{48}(n,2n)Ca^{47}$ reactions for 14.5 Mev neutrons are measured as 10 ± 2 and 0.9 ± 0.2 b, in agreement with calculated values. The cross sections of the $Ti^{48}(n,p)Sc^{48}$ and $Ti^{47}(n,p)Sc^{47}$ reactions are measured incidentally as 55 ± 11 and 99 ± 20 mb, respectively. The cross section is also obtained for the $V^{51}(n,\alpha)Sc^{48}$ reaction (18 ± 3 mb). (auth)

31091 STUDY OF ISOMERIC LEVELS OF Sb^{124}. Jean Vanhorenbeeck (Centre d'Étude de l'Énergie Nucléaire, Mol, Belg.). Nuclear Phys., 37: 90-105(Aug. 1962). (In French)

The β, γ, and conversion-electron spectra of short-lived isomeric levels of Sb^{124} are studied and β-γ and γ-γ coincidence studies are carried out. A decay scheme is proposed for these levels; it includes an excited state at 1753 kev in Te^{124}. (auth)

31092 EXCITED STATES OF ODD-MASS NUCLEI WITH SMALL NON-AXIALITY. A. S. Davydov and R. A. Sardaryan (Moscow State Univ.). Nuclear Phys., 37: 106-18(Aug. 1962). (In English)

The sequence of the spins and energy ratios of the excited states of odd-mass nuclei is calculated without differentiating between one-particle and collective excitations. The results of the theory are compared with experiments. (auth)

31093 LEVEL INVERSION IN Li^6. William F. Ford (Case Inst. of Tech., Cleveland). Nuclear Phys., 37: 119-25(Aug. 1962). (In English)

The ground state of Li^6 is a J = 1, T = 0 state and the 3.56 Mev level a J = 0, T = 1 state. These levels are examined in a three-body model of Li^6, using interactions whose spin dependence arises solely from tensor and spin-orbit parts. It is shown that if the $^3D_1$ multiplet admixture is negligible, the ground state of the three-body model is the J = 0 level. The reason for this inversion is discussed, and a wave function that enhances the $^3D_1$ state is suggested. Numerical results are presented showing that the level order is restored when this wave function is used. (auth)

31094 STUDY OF THE STRUCTURE OF LIGHT NUCLEI BY (p,2p) REACTIONS AT 155 Mev. J. P. Garron (Laboratoire Joliot-Curie de Physique Nucleaire, Orsay, France), J. C. Jacmart, M. Riou, C. Ruhla, J. Teillac, and K. Strauch. Nuclear Phys., 37: 126-46(Aug. 1962). (In French)

Summed energy spectra are studied that are displayed by protons emitted in coincidence in (p,2p) reactions induced by 155-Mev protons on the following target nuclei: Li^6, Li^7, B^{10}, B^{11}, and C^{12}. Two telescopes, each with 2 plastic scintillators and 1 NaI total-absorption scintillator, are used to detect the product protons. The summed energy spectra exhibit generally 2 well defined peaks, which define the binding energy. Angular correlation distributions are obtained for those events under each summed energy peak for which the 2 product protons are emitted in a plane symmetrically on each side of the incident beam and have approximately the same energy. Applying the Born approximation and neglecting nuclear absorption, momentum density distributions are deduced for protons in the target nuclei. The high-binding-energy proton distribution presents a maximum for zero momentum, characteristic of an s state; and the lower-binding-energy proton distribution presents a minimum for zero momentum, characteristic of a p state, except in the case of Li^6. Parameters of these distributions are given, which permit comparison among the various target nuclei. (auth)

31095 RADIATION OF LOW ENERGY QUANTA IN NUCLEAR REACTIONS. H. Feshbach (Massachusetts Inst. of Tech., Cambridge) and D. R. Yennie. Nuclear Phys., 37: 150-71(Aug. 1962). (In English)

The production of radiation concomitant with the elastic scattering of nucleons by nuclei is considered. It is shown that the first term of a series expansion of the differential radiation cross section in the energy of the radiated quantum may be expressed in terms of the elastic scattering amplitudes at the incident and final energies. This result is valid even when there are resonances in the scattering whose widths are a small fraction of the energy loss. The interference between these 2 amplitudes permits the determination of the shape elastic amplitude, and therefore the cross section for compound elastic scattering as well as the correlation distance (defined as the energy separation over which there is a substantial correlation in the fluctuations in the elastic scattering amplitude; its inverse measures the time delay in the reaction). When a resonance has a width of the order of the energy loss, the interference can be employed to evaluate the change of phase of the elastic scattering amplitude across the resonance, and may therefore serve as an indicator of whether or not a fluctuation in the elastic cross section is a resonance. These results when applied to reactions lead to a method for the measurement of the relative amount of direct and compound nuclear processes and to a direct test of the random phase approximation of the statistical hypothesis in nuclear reactions. A derivation of the principal result that is valid for relativistic particles is also given. (auth)

31096 OPTICAL HYPERFINE STRUCTURE AND MAGNETIC MOMENT OF Pu^{239}. L. A. Korostyleva. Optics and Spectroscopy, 12: 380-2(June 1962).

The hfs (hyperfine structure) of the spectrum of Pu^{239} is investigated in the 3900 to 6900-Å region. The width of the hfs splitting is determined for 236 lines. The magnetic interaction constants are determined for the $^8F_{5/2}$, $^8F_{7/2}$, $^8F_{9/2}$, $^6F_{5/2}$, $^6F_{7/2}$ terms of the electron configuration $5f^67s$. The magnetic splitting constant for the 7s electron is calculated from these values. From an analysis of the hfs, a positive sign is established for the magnetic moment of Pu^{239}. The magnitude of the magnetic moment is calculated to be +0.15 nuclear magnetons. (auth)

31097 NUCLEAR ALIGNMENT OF CERIUM ISOTOPES. M. A. Grace, C. E. Johnson, R. G. Scurlock, and R. T. Taylor (Clarendon Lab., Oxford). Phil. Mag. (8), 7: 1087-98(July 1962).

Angular distribution and polarization measurements on the 166 kev γ radiation from Ce^{139}, aligned in a crystal of neodymium ethyl sulfate, show this to be almost pure M1 radiation, $|\delta(E2/M1)|<0.02$ and yield a value for the nuclear moment for Ce^{139} of 0.85 ± 0.15 nm. Further alignment experiments were made on Ce^{141} using cerium magnesium nitrate and these confirm earlier results using neodymium ethyl sulfate. (auth)

31098 THE DECAY OF CHLORINE-36 TO SULPHUR-36. P. W. Dougan, K. W. D. Ledingham, and R. W. P. Drever (Univ. of Glasgow). Phil. Mag. (8), 7: 1223-30 (July 1962).

A study was made of the decay branches of chlorine-36 which lead to sulphur-36. The ratio of L-capture to K-capture was determined to be 0.112 ± 0.008, from measurements in a multi-wire proportional counter. Using scintillation techniques, a weak positron branch of intensity $(7^{+2}_{-1}) \times 10^{-4}$ relative to K-capture was detected, and a value of 1.7 ± 0.04 Mev obtained for the energy available for electron capture.

31099 RECOIL STUDIES OF REACTIONS OF INDIUM WITH MEDIUM ENERGY PROTONS AND ALPHA PARTICLES. N. T. Porile, A. M. Poskanzer, and M. Rho (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 128: 242-6(Oct. 1, 1962). (BNL-6138)

Recoil ranges projected along the beam direction have been measured for the $(\alpha,\alpha\gamma)$, $(\alpha,\alpha n)$, (α,pn), and $(p,p\gamma)$ reactions on In^{115} and for the $In^{113}(p,n)$ reaction, with 5 to 10 Mev protons and 20 to 40 Mev alpha particles. The results have been compared with values expected for compound-nucleus formation and reasonable agreement is obtained for the (α,pn), $(p,p\gamma)$, and (p,n) reactions. The measured range for the $(\alpha,\alpha n)$ reaction agrees with calculation at the lowest energy studied but is somewhat low at the highest bombarding energy. In the case of the $(\alpha,\alpha\gamma)$ reaction the measured ranges are a factor of 3 to 6 smaller than the calculated values, indicating a direct interaction process. The recoil ranges expected for Coulomb excitation have been computed for the $(\alpha,\alpha\gamma)$ and $(p,p\gamma)$ reactions and are substantially smaller than the experimental values. Excitation function measurements for the (α,pn) reaction are also presented. (auth)

31100 GAMMA RADIATION FROM LITHIUM-LITHIUM NUCLEAR REACTIONS. E. Berkowitz, S. Bashkin, R. R. Carlson, S. A. Coon, and E. Norbeck (State Univ. of Iowa, Iowa City). Phys. Rev., 128: 247-51(Oct. 1, 1962).

A three crystal pair spectrometer was used to determine the relative intensities of gamma radiation produced in the bombardment of separated Li^6 and Li^7 targets by Li^6 and Li^7 ions at energies of 2.6 and 3.6 Mev. The observed gamma radiation arises from excited states of residual nuclei. These include Be^{10}, B^{11}, B^{12}, B^{13}, C^{11}, and C^{12} in the present experiment. Relative populations deduced from the data indicate that a difference of one unit of charge for the matter transfered in the reaction does not strongly influence the relative cross sections. In particular, the production of B^{12} (ground state) and the equivalent state in C^{12} (15.11 Mev) in the bombardment of Li^7 by Li^6 were in the ratio 2:1. A value of 2.3:1 is predicted for this ratio on the basis of simple stripping theory and cluster breakup in this reaction. The relative populations of the excited states of B^{11} produced in the three reactions show systematic variations as a function of excitation. (auth)

31101 L/K-CAPTURE RATIO OF Zn^{65}. A. G. Santos Ocampo and D. C. Conway (Purdue Univ., Lafayette, Ind.). Phys. Rev., 128: 258-61(Oct. 1, 1961).

The L/K-capture ratio of Zn^{65} was determined to be 0.119 ± 0.007 in a high-pressure, multiwire, gas proportional counter with radioactive zinc dialkyl as the gaseous source. This value is significantly larger than the theoretical value of 0.097 predicted by Brysk and Rose. (auth)

31102 β-γ CIRCULAR-POLARIZATION CORRELATION IN THE DECAY OF Mn^{52}. H. Daniel, O. Mehling, O. Mueller, and K. S. Subudhi (Max Planck Inst. for Nuclear Physics, Heidelberg, Ger.). Phys. Rev., 128: 261-3 (Oct. 1, 1962).

The β-γ circular-polarization correlation in the decay of Mn^{52} has been measured by means of Compton forward scattering. The constant A was found to be A = 0.00 ± 0.02 which implies a value of x = −0.08 ± 0.03 for the ratio between Fermi and Gamow-Teller contributions to the decay (standard deviations). This result is in agreement with theoretical estimates. (auth)

31103 $Li^6(d,p_1)Li^7$ REACTION AT 2-Mev BOMBARDING ENERGY. V. M. Rout and W. M. Jones (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). Phys. Rev., 128: 263-4(Oct. 1, 1962).

Absolute differential cross sections and reduced widths have been obtained for the reactions $Li^6(d,p_0)Li^7$ and $Li^6(d,p_1)Li^{7*}$. (auth)

31104 STUDY OF THE REACTIONS $Pr^{141}(C^{12},4n)Tb^{149}$ AND $Te^{130}(C^{12},5n)Ce^{137m}$ BY MEANS OF RECOIL TECHNIQUES. John R. Morton, III, Gregory R. Choppin, and Bernard G. Harvey (Univ. of California, Berkeley). Phys. Rev., 128: 265-73(Oct. 1, 1962). (UCRL-10031)

The reactions $Pr^{141}(C^{12},4n)Tb^{149}$ and $Te^{130}(C^{12},5n)Ce^{137m}$ were examined by means of recoil techniques. The experimental angular distributions were compared with distributions calculated by a Monte Carlo method, based upon the compound nucleus and statistical models, with a neutron angular distribution of the form $W(\theta)d\Omega = (A + B\cos^2\theta)d\Omega$. The results from the $Pr^{141}(C^{12},4n)$ reaction are in agreement with the simple theory. The $Te^{130}(C^{12},5n)$ data can be explained by formation of a compound nucleus which de-excites with enhanced probability for gamma emission. (auth)

31105 PHOTOPRODUCTION OF A 100-μSEC ISOMER AND ITS TENTATIVE ASSIGNMENT TO Hg^{201}. P. Euthymiou (Univ. of Athens) and P. Axel. Phys. Rev., 128: 274-80(Oct. 1, 1962).

The photoproduction of a 100 ± 6-μsec isomer from a natural Hg target was studied as a function of bremsstrahlung energy by detecting the 533 ± 7 kev gamma ray which dominates the decay. The isomer is produced mainly by a (γ,n) process which has an apparent threshold of 11.3 ± 0.3 Mev and an integrated cross section of 33 Mev mb if the 30% isotope Hg^{202} is the parent. In the energy range from 9 to 12 Mev, the isomer is probably produced by a (γ,γ') process. The tentative isotopic assignment is stengthened by the presence of what is apparently the same decay gamma ray in the 22-min Au radioactivity which is usually assigned to Au^{201}. Prompt beta-gamma coincidences were observed for Au^{199} and Au^{200} but no prompt coincidences were found for Au^{201}. The Au^{201} activity has a half life of 22 ± 3 min and a 530 ± 5 kev gamma ray. (auth)

31106 (p,n) CROSS SECTIONS OF V^{51}, Cr^{52}, Cu^{63}, Cu^{65}, Ag^{107}, Ag^{109}, Cd^{111}, Cd^{114}, AND La^{139} FROM 5 TO 10.5 Mev. J. Wing and J. R. Huizenga (Argonna National Lab., Ill.). Phys. Rev., 128: 280-90(Oct. 1, 1962).

The (p,n) cross sections were measured by the activa-

tion technique in the energy range 5 to 10.5 Mev for the target nuclides V^{51}, Cr^{52}, Cu^{63}, Cu^{65}, Ag^{107}, Ag^{109}, Cd^{111}, Cd^{114}, and La^{139}. Approximate proton reaction cross sections were obtained at energies below the (p,2n) threshold by adding to the (p,n) cross sections the previously reported charged-particle-emission (p,q) cross sections. These results are compared at a few energies with volume absorption and surface absorption optical-model calculations of the proton reaction cross sections. (auth)

31107 STATISTICAL THEORY PREDICTIONS FOR 5- TO 11-Mev (p,n) AND (p,p') NUCLEAR REACTIONS IN V^{51}, Co^{59}, Cu^{63}, Cu^{65}, AND Rh^{103}. Luisa F. Hansen and Richard D. Albert (Univ. of California, Livermore). Phys. Rev., 128: 291-9(Oct. 1, 1962). (UCRL-6686)

Absolute (p,n) cross sections for proton energies between 5 and 11 Mev have been measured for V^{51}, Co^{59}, Cu^{63}, Cu^{65}, and Rh^{103} using a "long counter." The experimental values are compared with the predictions of the statistical theory. An analysis is made of the use of different level density functions in the calculations of the cross sections. The choice of parameters—the nuclear radius r_0, the level density parameter a, and pairing energies, P(Z,N)—has been made with the idea of fitting not only these measured (p,n) cross sections but also other available experimental information such as the proton-reaction cross section, $\sigma(p,p')$, the differential energy spectrum of the neutrons resulting from these proton reactions, and some of the proton spectra from the (p,p') reaction for the copper isotopes. It is shown that the "measured" value of a changes drastically from approximately A/20 or A/30 to approximately A/8 to A/6 depending upon whether $\exp\{2[a(U + P(Z,N))]^{\frac{1}{2}}\}$ or $[U + P(Z,N)]^{-2} \exp\{2[a(U + P(Z,N))]^{\frac{1}{2}}\}$ is used for the level density. However, the (p,n) and (p,p') cross sections obtained with these level density functions when the correspondence a is introduced are quite close. In most of the cases it is not possible to make a definite choice if the accuracy of the measured cross sections is not better than 5%. (auth)

31108 LEVEL STRUCTURE IN Ne^{22} AND Si^{30} FROM THE REACTIONS $O^{18}(\alpha,n)Ne^{21}$ AND $Mg^{26}(\alpha,n)Si^{29}$. J. K. Bair and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev., 128: 299-304(Oct. 1, 1962).

Compound states of high excitation in Ne^{22} and Si^{30} have been observed in the total neutron yield from the reaction $O^{18}(\alpha,n)Ne^{21}$ and $Mg^{26}(\alpha,n)Si^{29}$. In the case of Ne^{22}, twenty-five resonances were observed, varying in width from 5 to 150 kev for alpha bombarding energies from 2.5 to 5 Mev (excitation energy from 11.7 to 13.8 Mev). The reaction $Mg^{26}(\alpha,n)Si^{29}$ showed forty resonances varying in width from less than 10 to 60 kev for alpha energies from 3 to 5.3 Mev (excitation energy from 13.3 to 15.3 Mev). Absolute cross sections were measured for both reactions. A statistical analysis of the area under the excitation curves gives an alpha-particle strength function $\overline{S}_\alpha = 0.02_8$ for $O^{18} + \alpha$ and $\overline{S}_\alpha = 0.01_6$ for $Mg^{26} + \alpha$. Analysis of the individual resonances in $O^{18} + \alpha$ gives a value of $\langle\gamma_\alpha^2\rangle/D \leq 0.04$, in agreement with the $\overline{S}_\alpha$ obtained by the statistical analysis. The strength functions are probably reliable to better than a factor of 2. (auth)

31109 HIGHLY EXCITED STATES IN C^{11}. ELASTIC SCATTERING OF PROTONS BY B^{10}. J. C. Overley and Ward Whaling (California Inst. of Tech., Pasadena). Phys. Rev., 128: 315-24(Oct. 1, 1962).

Excitation functions for the elastic scattering of protons by B^{10} have been measured at center-of-mass scattering angles near 90°, 125°, and 160°, for proton energies between $E_p = 0.15$ Mev and $E_p = 3.0$ Mev. Scattering angular distributions were measured at 43 selected energies in this range. An excitation function for the reaction $B^{10}(p,\alpha_0)Be^7$ was also measured between $E_p = 1.5$ Mev and $E_p = 2.6$ Mev at a laboratory angle of 90°. The atomic stopping cross section of boron for protons has been determined between $E_p = 0.1$ Mev and $E_p = 3.0$ Mev. The elastic scattering excitation functions exhibit conspicuous anomalies at $E_p = 1.50$ Mev and $E_p = 2.180$ Mev. The α_0 transition to the ground state of Be^7 is also resonant at $E_p = 2.180$ Mev. The behavior of the cross sections in these regions has been analyzed in terms of compound states of C^{11}. Satisfactory agreement is achieved with level assignments of $J^\pi = \frac{1}{2}^+$ with $E_R = 1.50$ Mev, $\Gamma_p = 90$ kev, $\Gamma_T = 250$ kev; and $J^\pi = \frac{3}{2}^+$ with $E_R = 2.180$ Mev, $\Gamma_p = 100$ kev, $\Gamma_{\alpha_0} = 100$ kev, and $\Gamma_T = 200$ kev. Although complete analysis of the scattering is hindered by the influence of unknown processes, the negative parity assignment for the previously reported state at $E_p = 1.17$ Mev, derived from other reaction experiments, appears inconsistent with the scattering. (auth)

31110 ABSOLUTE TRANSITION PROBABILITIES IN THE ODD-ODD NUCLEUS Pr^{144}. J. Burde, M. Rakavy, and G. Engler (Hebrew Univ., Jerusalem). Phys. Rev., 128: 325-32(Oct. 1, 1962).

The lifetimes of three levels of the odd-odd Pr^{144} nucleus were determined by coincidence measurements between the beta spectrum of Ce^{144} and the conversion lines de-exciting the levels under investigation, using a double-lens coincidence spectrometer. The measurements were carried out using both the conventional self-comparison method and a modified version of this technique particularly appropriate for low-energy transitions. The mean lifetimes of the 133.5-, 100-, and 80.1-kev levels were found to be: $(0.95 \pm 0.5) \times 10^{-11}$ sec, $(1.0 \pm 0.2) \times 10^{-9}$ sec, and $(1.8 \pm 0.2) \times 10^{-10}$ sec, respectively. The transition probabilities agree very well with those derived from shell calculations in terms of coupling between the odd neutron and odd proton, if values of the "effective moments" are used in the calculation. The following assignments for the unpaired neutron-proton confiurations provide a consistent description of the states:

Ground state: $|f_{\frac{5}{2}}, g_{\frac{7}{2}}; 0-)$.
80-kev Level: $0.37\ |f_{\frac{5}{2}}, g_{\frac{7}{2}}; 1-) + 0.93\ |f_{\frac{5}{2}}, d_{\frac{3}{2}}; 1-)$.
100-kev Level: $|f_{\frac{5}{2}}, g_{\frac{7}{2}}; 2-)$.
133-kev Level: $-0.93\ |f_{\frac{5}{2}}, g_{\frac{7}{2}}; 1-) + 0.37\ |f_{\frac{5}{2}}, d_{\frac{3}{2}}; 1-)$.

(auth)

31111 STUDY OF THE $K^{39}(d,d')$ REACTION. E. W. Hamburger (Universidade de Sao Paulo, Brazil) and L. H. Reber. Phys. Rev., 128: 333-7(Oct. 1, 1962).

Elastic and inelastic scattering of 15-Mev deuterons from a natural potassium target was measured at ~12 scattering angles between 25 and 90°. Angular distributions corresponding to the following levels in K^{39} were obtained: 2.53, 2.82, 3.02, 3.60 Mev and to groups of unresolved levels at 3.88 and 3.94 Mev and at 4.08, 4.09, and 4.12 Mev. All distributions show a peak at small angles; all, except the one to the 2.53-Mev level, have almost identical shapes. The most strongly excited state is at 3.60 Mev with a peak cross section of 1.1 mb/sr at 34°. The data suggest that the 2.53-Mev level has positive parity, while all the other levels have negative parity and contain appreciable admixtures of a collective octupole vibrational state. (auth)

31112 PROPERTIES OF EXCITED STATES OF P^{31}. I. GAMMA-RAY SPECTRA AND DECAY SCHEMES. Gale I. Harris and L. W. Seagondollar (Univ. of Kansas, Lawrence). Phys. Rev., 128: 338-51(Oct. 1, 1962).

Gamma ray decay schemes of the resonances in the reaction $Si^{30}(p,\gamma)P^{31}$ at E_p = 1177, 1204, 1324, 1392, 1400, 1481, 1489, and 1509 kev are proposed from a study of pulse-height spectra and coincidence measurements. With some exceptions, the decay properties of intermediate states of P^{31} are found to be in agreement with previously existing information. The exceptions are (1) The 3.51-Mev level appears to decay to either the 1.27- or to the 2.23-Mev level (or both) in addition to the well-known decay to the ground state (2) The 4.26-Mev level decays to the ground state and to the first excited state with the relative intensities 84% and 16%, respectively. (3) The 5.01-Mev level decays to the first excited state in addition to the previously reported decay to the ground state. Evidence is presented for the decay properties of the 4.63- and 4.78-Mev levels for which there is no previous information. Evidence is presented for the existence of four bound states between 5- and 7-Mev excitation which have not been previously reported. A relatively strong and well isolated transition to the 3.41-Mev level was found at the 1509-kev resonance. This transition is of considerable interest because it can be used to determine the spin and parity of the 3.41-Mev level for which no assignments exist. (auth)

31113 SOME GAMMA-RAY CASCADES IN Rh^{103}, Ce^{140}, AND Dy^{160}. S. I. H. Naqvi and B. G. Hogg (Univ. of Manitoba, Winnipeg, Can.). Phys. Rev., 128: 357-61(Oct. 1, 1962).

The 445-53 kev cascade in Rh^{103} was found to have an intensity <0.5 relative to 1000 for the intensity of the most intense, 498-kev, gamma ray in the decay scheme. No evidence was found for a 323-kev gamma ray in this scheme. Spins of $^5/_2$ for the 538-kev level and $^7/_2$ for the 650-kev level in Rh^{103} are assigned in keeping with the relative intensities of <0.5 and 4 for the 445- and 538-kev gamma rays, respectively. Cascades of 1088-814, 1415-487, and 1596-306 kev have been observed in Ce^{140} and a level at 3498 kev introduced into the scheme. The beta feed to this level is estimated to be ~0.002% of the most intense beta group in the decay of La^{140}. Cascades of 87-1312 and 197-1200 have been observed in Dy^{160} and a level at 1484 kev is introduced. (auth)

31114 THE COEFFICIENT OF INELASTICITY IN VERY HIGH ENERGY NUCLEAR COLLISIONS. Jerzy Massalski (Inst. of Nuclear Research, Division of High Energy, Krakow). Postepy Fizyki, 13: 137-53(1962). (In Polish)

In a nucleon-nucleon or nucleon-nucleus collision, the coefficient of inelasticity K is defined as that fraction of the total kinetic energy in the center-of-mass system, before collision, that is imparted to newly formed particles. The value of K depends on the spatial distribution of energy around the core of the nucleon, and similarly on the relative strengths of interaction of the incident nucleon with the core of another nucleon and with the mesonic field. The relationship of K and the attenuation length in bulk matter is treated. The measuring techniques discussed include the attenuation length, nuclear emulsion techniques in measuring K, the combination of Wilson cloud chamber and ionization calorimeter, and the nuclear emulsion chamber (alternate layers of high Z material and nuclear emulsions). A review of experimental work includes the variation of the total-K and the pi-mesonic component of K, K(pi), with the mass of the target nucleus and with the energy of the incident particle. In the energy ranges discussed, from less than 10^{11} ev to 10^{13} ev, K(pi) varies non-monotonically from 0.1 to about 1.0. (TTT)

31115 ON THE EFFECT OF WASHING OUT OF NUCLEUS BOUNDARIES ON DIFFRACTION SCATTERING. E. V. Inopin and Y. A. Berezhnoi. Ukrain. Fiz. Zhur., 7: 343-8(Apr. 1962). (In Ukrainian)

Elastic and non-elastic diffraction scattering of fast particles by nuclei with a washed-out boundary is studied. The theory developed is applicable to the scattering of α particles by Mg^{24} nuclei. An estimation is given of the free path of α particles in nuclear matter. Agreement between theory and experiment is obtained. (auth)

31116 STUDY OF THE PROPERTIES OF LIGHT NUCLEI ON THE BASIS OF A GENERALIZED MODEL. B. I. Tishchenko and A. A. Kresnin. Ukrain, Fiz. Zhur., 7: 349-56(Apr. 1962). (In Ukrainian)

A generalized model is applied for finding the nuclear characteristics of light nuclei ($4 < A \leq 40$). Use is made of wave functions and energies of one-particle states, permitting calculations for strongly deformed nuclei with fair precision. The values obtained for the equilibrium deformations, spins, and magnetic and quadrupole moments agree with experimental values. (auth)

31117 ON ALLOWING FOR THE CORRELATION BETWEEN NUCLEONS IN THE PHOTOEFFECT. A. G. Sitenko and O. V. Drobachenko. Ukrain. Fiz. Zhur., 7: 357-60(Apr. 1962). (In Ukrainian)

The interaction between nucleons in a nucleus with a large mass number may be allowed for on considering the thermal excitation of the nucleonic Fermi gas at temperatures corresponding to energies of 5 or 8 Mev. Formulae are obtained for the integral cross section of the nuclear dipole photoabsorption and the average energy of the absorbed photons, analogous to the formulae for a Fermi gas with non-interacting nucleons. Allowing for the proton-neutron correlation leads to a increase in the average energy of photoabsorption. (auth)

31118 ON THE EFFECT OF REPULSION FORCES BETWEEN NUCLEONS ON THE PHOTOEFFECT CROSS-SECTION. O. V. Drobachenko. Ukrain. Fiz. Zhur., 7: 361-5(Apr. 1962). (In Ukrainian)

To find the integral cross section for nuclear photoabsorption and the mean energy of the absorbed photons, application is made of the nuclear photoeffect theory of Levinger and Bethe (Phys. Rev. 78: 115(1950)), who on the basis of a model of independent particles, consider the exchange nature of paired forces by means of the rule of sums for dipole transitions. The expression for the part of the potential describing the repulsive core commutates with the complete hamiltonian of the nucleus. The results are, therefore, fully described by the "displaced" deformed potential of attraction taken in the form of rectangular well. The parameters of the displaced potential are calculated on the basis of experimental data on the scattering of neutrons by protons, with the help of the effective radius theory. It is found that allowing for the forces of repulsion between nucleons leads to a considerable increase both of the mean energy of the absorbed photons and of the integral cross section for photoabsorption. (auth)

31119 CALCULATION OF THE ELASTIC SCATTERING FOR 19.6 Mev PROTONS ACCORDING TO AN OPTICAL MODEL OF THE NUCLEUS. R. A. Vanetsian, A. P. Klucharev, G. F. Timoshevskii, and E. D. Fedchenko. Ukrain. Fiz. Zhur., 7: 378-82(Apr. 1962). (In Ukrainian)

The differential cross sections for the elastic scattering of 19.6-Mev protons on separated isotopes of Co^{59}, Cu^{65}, Cd^{111}, Cd^{116}, Sn^{116}, and Sn^{124} are calculated by employing a complex potential in an optical model. The real part of the potential is chosen in the Saxon form and the imaginary part in the Gaussian form. An attempt to obtain agreement between the experimental data and calculations made with

the imaginary part of the optical potential in the Saxon form is not successful. It proves impossible to make the experimental data consistent with the optical model calculations in the case of small angles (20 to 40°). (auth)

31120 POLARIZATION OF PROTONS FROM THE REACTION $D(d,p)H^3$. N. A. Skakun, A. K. Walter, and A. P. Klyucharev. Ukrain. Fiz. Zhur., 7: 383-6(Apr. 1962). (In Ukrainian)

The polarization of protons from the reaction $D(d,p)H^3$ was determined by measuring the asymmetry of elastically scattered protons on helium. Selection of coincidences permitted reduction of the background from neutrons from the symmetrical reaction $D(d,n)He^3$. At a c.m.s. angle of 45° at energies of 0.72, 1.10, and 1.48 Mev, the degree of polarization proved equal to -17 ± 8, -18 ± 9, and $-15 \pm 9\%$ respectively. Measurements were taken on a thin gas target. (auth)

31121 ON STRIPPING REACTION THEORY. Yu-tai Tsian and A. M. Korolyov. Ukrain. Fiz. Zhur., 7: 470-5 (May 1962). (In Ukrainian)

The Born approximation for a simple single-particle nuclear model is used to calculate the effective differential cross section of the stripping reaction (d,p) on even-even spherical nuclei, taking into account the impurity D-wave admixture to the deuteron wave function, which is regarded as a cause of the rise in the experimental curves with large angles of proton escape. The relative contribution of the D-wave admixture to the angular distribution of the proton escape angles for deuteron energies up to 20 Mev is found. It is found that in the region of small angles of escape the relative contribution that in the region of small angles of escape the relative contribution of D-wave admixture is actually small, but at large angles it may increase the cross section by 16 per cent. In addition, in the limiting case of zero radius of tensor forces the relative contribution of the D-wave admixture to the angular distribution rapidly rises and with large angles it may increase the Butler cross section by a factor of more than two. (auth)

31122 ON CALCULATION OF ENERGY OF THREE NUCLEON BOUND STATE. Yu. P. Shcherbin. Vestnik Leningrad. Univ., No. 10, Ser. Fiz. i Khim., No. 2, 5-16 (1962). (In Russian)

An approximate expression for principal functions of the three nucleon bound state was derived considering the central, tensor, $\vec{L}\vec{S}$ two nucleon interactions, and the three-body potential. It was shown that it is possible to obtain the principal functions of the bound state by solving a system of two nonlinear equations. The properties of that solution of the system that corresponds to the physical case are being elucidated. (auth)

31123 THE NUMBER OF NEUTRONS EMITTED BY U^{235} IN THE REGION OF SYMMETRICAL FISSION. V. F. Apalin, Yu. N. Gritsyuk, I. E. Kutikov, V. I. Lebedev, and L. A. Mikaelyan. Zhur. Eksptl'. i Teoret. Fiz., 43: 329-30 (July 1962). (In Russian)

The change in the number of neutrons emitted in the process of fission was investigated for various ratios of the fission product masses. A double ionization chamber having grids to measure the mass distribution of fission products was used to detect the fission products obtained by the fission of U^{235} by thermal neutrons. A 4π neutron counter was used to count the fission neutrons. The ratio of the masses of the fission products $X = M_H/M_L$ is plotted as a function of the number of neutrons emitted $\nu(X)$. The minimum number of neutrons (about 2.05) are emitted as a mass ratio of 1.20 to 1.25. The total kinetic energy of the fission products is a maximum at this point, and is equal to ~180 Mev. At large mass ratios the number of fission neutrons increases slowly to about 2.6. It was found that the number of emitted neutrons rose sharply on approaching symmetrical fission. At a mass ratio of 1.0 to 1.04, it was found that 3.6 neutrons were recorded per fission event, but this value is low if the low resolving power of the mass analyzer is taken into account. Calculations show that the experimental results are in agreement with the assumption that ~6 neutrons are emitted during symmetrical fission. (TTT)

31124 MEASURING THE PROBABILITY FOR THE REACTION $\mu^- + He^3 \rightarrow H^3 + \nu$. O. A. Zaimidoroga, M. M. Kulyukin, B. Powtekorvo, R. M. Sulyaev, I. V. Falomkin, A. I. Filippov, V. M. Tsupko-sitnikov, and Yu. A. Shcherbakov (United Inst. of Nuclear Studies, USSR). Zhur. Eksptl'. i Teoret. Fiz., 43: 355-8(July 1962). (In Russian)

A diffusion chamber in a magnetic field H = 6000 Oe was filled with He^3 gas at a pressure of 20 atm, and was irradiated with a beam of mesons having a momentum of 217 Mev/c. The mesons were slowed down with a copper filter placed in front of the chamber. About 10^5 photographs were subjected to a double scan for tracks having a length $L_0 > 20$ mm in order to identify the mesons that were stopped. The total number of events from the reaction $\mu^- + He^3 \rightarrow H^3 + \nu$ was established by counting all stars at a range of 2.0 to 2.6 mg/cm². A total of 106 events was observed at $L_0 > 20$ mm. The number of μ-e decays observed was 35,500. The absolute capture probability was determined from the known lifetime of the muon (2.21×10^{-6} seconds) and the above data. The probability of the above reaction was found to be $\Lambda\,(He^3)_{exp} = (1.36 \pm 0.18)\ 10^3\ sec^{-1}$. This value agrees well with a theoretical value of $\Lambda\,(He^3)_{theor} = 1.54 \times 10^3\ sec^{-1}$. (TTT)

31125 IZOBARNYE YADRA S MASSOVYM CHISLOM A = 140. (Isobaric Nuclei with the Mass Number A = 140). B. S. Dzhelepov, V. P. Prikhodtseva, and Yu. V. Khol'nov. Svoistva Atomnykh Yader. Vypusk 5. Moscow-Leningrad, Publishing House of the Academy of Sciences, 1960. 97p.

A compilation of data is given on isobaric nuclei with mass number A = 140. Critical analysis was made of data on radioactivity, decay scheme, quantum characteristics, and excited states of 7 known nuclei in the transformation chain: $Xe^{140} \rightarrow Cs^{140} \rightarrow Ba^{140} \rightarrow La^{140} \rightarrow Ce^{140} \leftarrow Pr^{140} \leftarrow Nd^{140}$. (R.V.J.)

Particle Accelerators

31126 (BNL-741) ACCELERATORS OF THE FUTURE. John P. Blewett (Brookhaven National Lab., Upton, N. Y.). June 13, 1962. Contract [AT(30-2)-Gen-16]. 16p.

Brookhaven Lecture Series No. 18.

The development of linear accelerators and synchrotrons for energies higher than 1 Bev is discussed. High-intensity, colliding-beam, and super-high-energy accelerators are described. Design proposals are outlined. (M.C.G.)

31127 (BNL-5007) MEASUREMENT OF RANGE AND INTENSITY OF CYCLOTRON BEAMS. J. R. Grover, B. M. Foreman, Jr., B. D. Pate, C. P. Baker, and J. Hudis (Brookhaven National Lab., Upton, N. Y.). [1959]. Contract [AT-(30-2)-Gen-16]. 16p.

An assembly of a Faraday cup, foil wheel, and target holder is described. Provision is made for the convenient measurement of the energy of cyclotron-accelerated ions by means of their range in aluminum, and for determination both of instantaneous and of integrated beam intensity. This system is intended for use in the measurement of cross

sections and excitation functions by the activation of metal foils or other thin targets. As a check on its operation, the maximum cross section for the reaction $Bi^{209}(\alpha,2n)At^{211}$ was measured and found to be 0.99 ± 0.04 barns at about 30.5 Mev, in agreement with previous determinations. (auth)

31128 (ORNL-3257) ELECTRONUCLEAR DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1961. (Oak Ridge National Lab., Tenn.). Aug. 24, 1962. Contract W-7405-eng-26. 79p.

With 27.5-Mev N^{3+} ions accelerated in the 63-inch cyclotron, results were obtained on the angular and energy distributions of transfer reactions, transfer reaction systematics, the effect of angular momentum on the statistical model of the nucleus, and on angular distribution of alpha particles which result from a direct reaction of N^{14} with Li^6 and Li^7. In continuation of the 22-Mev proton program at the 86-inch cyclotron, the structure of nuclei is being studied with pickup reactions and inelastic scattering of protons, and the details of energy levels in neutron-deficient isotopes are being analyzed in the rare-earth region. An optical model search program is being used in theoretical studies related to these experimental programs. The 86-inch cyclotron continues to be the chief source for neutron-deficient isotopes, now being produced for commerical processors. Fixed-frequency acceleration of electrons to kinetic energies comparable to their mass equivalent was achieved in Electron Analogue II. The successful operation of this 8-sector electron cyclotron fully confirms the orbit studies and construction techniques. This demonstrates the feasibility of an 800 to 1000 Mev proton accelerator for which conceptual designs are being prepared. The high-field 2-in. ID solenoid was completed and now operates with steady magnetic fields in excess of 100 kilogauss. It is being used in studies of the properties of superconductors, such as the niobium-zirconium alloys. At 4°K a model magnet with 5000-turns of Nb-Zr produced a self field of 32 kilogauss before the superconductor returns to the resistive state. Fabrication and installation of the Oak Ridge Isochronous Cyclotron (ORIC) is approaching completion. This versatile three-sector AVF machine is being readied for a period of test operation at a reduced power level before being operated at design level, 1 ma of 75-Mev protons or 100-Mev nitrogen ions. (auth)

31129 (UCRL-6810) PERFORMANCE TESTS AND LIFE DATA OF THE 36-MEGAWATT MODULATOR DEVELOPED FOR THE ASTRON 1000-MEGAWATT ELECTRON ACCELERATOR. Vernon L. Smith (California. Univ., Livermore. Lawrence Radiation Lab.). July 24, 1962. Contract W-7405-eng-48. 42p.

The 36-Mw modulator, utilizing a type 5949A hydrogen thyratron, was developed to pulse magnetic cores used in the 1000-Mw peak-power Astron linear electron accelerator. The type 5949A hydrogen thyratron is run at 32 kv, 2500 amp peak current (5X rating), 0.4-μsec pulse length, and 60 pps. The system requires 500 thyratrons operated in parallel which results in a peak-power output of over 15,000 Mw. The modulator has an 800-hour tube life, low anode delay drift of 5 nsec at constant operating parameters, low anode delay drift of 20 nsec over a wide range of anode voltage and repetition rates, long term (up to 800 hr) anode delay drift of 50 nsec, rise time of 50 nsec with low ripple in a 7-ohm circuit giving a current rate of rise of 50,000 amp/μsec, positive output without significant deterioration of the rise time, and prefire rates as low as one per 400,000 pulses. (auth)

31130 (UCRL-9378) PARTICLE ACCELERATORS. Hayden S. Gordon and Gerald A. Behman (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 1, 1960. Contract W-7405-eng-48. 78p.

The principal types of particle accelerators are described briefly according to operation and history. Known operating particle accelerators are listed with their pertinent dimensions. (auth)

31131 (UCRL-9435) THE RCA 6949 AS A SELF-EXCITED CYCLOTRON OSCILLATOR. Bob H. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 25, 1960. Contract W-7405-eng-48. 24p.

The oscillator of the 88-in. cyclotron which is being built in Berkeley is tunable from 5.3 to 16.5 Mc. It delivers a maximum c-w power of 300 kw. At the rated dee voltage of 75 kv the resonator stores 4.5 joules of electrical energy. The transients produced by this amount of energy, during sparking, place unusual requirements upon the design of the oscillator tube. The features of the oscillator which make it particularly well-suited to this type of application are discussed. Other topics covered are the oscillator anode power supply, the hard-tube modulator, protective equipment, and oscillator instrumentation. (auth)

31132 (UCRL-9632) CYCLOTRONS. Bob H. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 4, 1961. Contract W-7405-eng-48. 8p.

The structure and operation of cyclotrons are discussed. Factors limiting cyclotron size and energy are given. Improvements to the basic continuous-wave cyclotron are described, including frequency modulation, strong focusing, and variable-energy facilities. (auth)

31133 THE ASKLEPITRON 35, A 35-Mev BETATRON FOR MODERN RADIOLOGY. L. Pittet. Brown Boveri Rev., 49: 151-72(May 1962). (In English)

A description is given of a special version of the betatron, developed for deep-ray therapy. Medical requirements for therapy with beta and gamma rays are reviewed. Possible improvements are discussed. (auth)

31134 BUNCHING PHENOMENA DURING ELECTRON INJECTION INTO THE BETATRON. II. THEORY OF STARTING CONDITIONS. M. Seidl (Inst. of Vacuum Electronics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys., 12: 508-22(1962). (In English)

A theory of the azimuthal bunching of electrons injected into the betatron is presented and compared with the experiments. The bunching is treated as a small perturbation of the stationary beam. The stationary injected beam is replaced by the corresponding equilibrium beam of the same perveance so that the angular velocity spread of the injected electrons is proportional to the square root of the injection perveance. Self-consistent wave solutions for the perturbation of the stationary solution are then found. Equations giving the amplification of small density or energy disturbances along the beam are derived. These disturbances are assumed to be introduced by density or velocity modulation of the injected beam. The condition for the spontaneous occurrence of bunching is deduced by assuming that the disturbances do not vanish even when there is no modulation of the injected beam. The resulting expressions for the threshold perveance and the rise-time of the disturbance are in agreement with experiments. Such agreement may be considered as verification of the statement that the amplification of the disturbances is caused by the "negative mass instability" mechanism. (auth)

31135 MICROTRON-ELECTRON CYCLOTRON. Roman Śledziewski (Physical Inst. of Jagiellón Univ., Krakow). Postepy Fizyki, 13: 335-52(1962). (In Polish)

The microtron is a type of cyclotron that can accelerate light, relativistic particles such as Mev electrons. The relativistic variation of mass changes the cyclotron frequency of the electron for a given value H of the magnetic field, and this change is corrected for by varying the driving frequency of the electric field, the strength of H, or both simultaneously. Only one accelerating gap is employed. It is a resonance cavity through which the electron trajectory always passes. These machines were built to accelerate electrons to 29 Mev, while no fundamental difficulties stand in the way of raising this value to 100 Mev. In conjunction with a linear accelerator, these machines should be able to accelerate electrons and protons to Bev energies. Several authors have proposed this type of accelerator. In this review, a complete list of all but the past review articles is given. The basic principles of microtron operation, the theoretical foundations, the construction of the magnet, the vacuum system, the resonance cavity and high frequency system, the extraction mechanism, and phase stability are discussed. (TTT)

31136 STABILITY OF A CHARGED BEAM IN A WAVEGUIDE CYCLE ACCELERATOR. Yu. A. Salivon. Zhur. Tekh. Fiz., 32: 835-9(July 1962). (In Russian)

High-density beam stability in a diaphragmed waveguide is analyzed considering the proper field force. (R.V.J.)

Plasma Physics and Thermonuclear Processes

31137 (LADC-5226) THE ELECTRICAL RESISTIVITY OF A PARTIALLY IONIZED CESIUM PLASMA. Duane Roehling (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-eng-36]. 18p.

The electrical resistivity of a partially ionized cesium plasma was measured by direct current methods at temperatures ranging from 1100 to 1900°K and for cesium equilibrium temperatures of 250 (p = 0.5 mm Hg), 275 (p = 1.0 mm Hg), and 340°C (p = 5.0 mm Hg). The measurements were made in a cell consisting of two parallel tungsten plates, one of which was guard ringed to avoid edge effects. By measuring total resistance versus separation distance the plasma resistance was separated from the sheath resistance and a plasma resistivity obtained. The resistivity ranged from approximately one ohm-cm at the high temperature to a few thousand ohm-cm at the low temperatures. Scattering cross sections for electron-neutral atom collisions were calculated from the resistivity measurements. These cross sections are valid for a cesium plasma having electrons with a Maxwellian velocity distribution. The values of the cross section range from approximately 7×10^{-15} cm^2 at 1100°K to approximately 15×10^{-15} cm^2 at 1870°K with an accuracy of about 50%. (auth)

31138 (NP-11995) PLASMA MODELS DESCRIBING PROPAGATION IN MAGNETO-IONIC MEDIA. Technical Report No. 1. Richard E. Haskell and E. Howard Holt (Rensselaer Polytechnic Inst., Troy, N. Y. Plasma Research Lab.). June 1961. 21p.

Two three-dimensional plasma models were constructed from Appleton's equation for the case of a longitudinal magnetic field. They are called the electron density model and the collision frequency model. The coordinates of the models are the real and imaginary parts of the propagation constant and the magnetic field strength. The distinction between the ordinary and the extraordinary wave is observed. The propagation properties of the medium described by the models is discussed. (auth)

31139 (NRL-5805) STARK BROADENING OF HYDROGEN AND HYDROGENIC NEUTRAL AND IONIZED HELIUM LINES IN A PLASMA. H. R. Griem (Maryland, Univ., College Park; Naval Research Lab., Washington, D. C.); A. C. Kolb (Naval Research Lab., Washington, D. C.); and K. Y. Shen (Long Beach State Coll., Long Beach, Calif.). May 17, 1962. 22p.

The frequency distributions of hydrogen, ionized helium, and hydrogenlike neutral helium lines broadened by the local fields of both ions and electrons in a plasma were calculated in the classical path approximation. The electron collisions were treated by an impact theory which takes into account the Stark splitting caused by quasi-static ion fields. The ion field strength distributions used include the effect of electron shielding and ion-ion correlations. The various approximations employed were examined for self-consistency, and an accuracy of about 10% in the resulting line profiles is expected, except on the far wings of the lines. An extensive set of Stark profiles is presented graphically for the ionized helium lines at 4686 and at 3203 Å for electron densities in the range 10^{15} to 10^{19} cm^{-3} and temperatures from 5000 to 80000°K. For the neutral helium lines at 3965 and 4471 Å, curves are given for N = 3×10^{17} cm^{-3} and T = 20000°K, where the two lines are hydrogenic. All profiles are also tabulated, as are those for the hydrogen lines Ly $-\alpha$, Ly $-\beta$, Hα, Hγ, and Hδ. A more complete and accurate table for Hβ is included. (auth)

31140 (TID-14434) STUDIES OF PLASMA OSCILLATIONS. Quarterly Status Report No. 7, June 1 – August 31, 1961. (Stanford Univ., Calif. Microwave Lab.). Oct. 1961. Contract AT(04-3)-326. 16p. (ML-865)

Progress in a study of plasma oscillations aimed at explaining the mechanism of instability growth in gaseous discharge is reported. Particular emphasis is being placed on the actions of sheaths and wave interactions with particles in the discharge. Theoretical work on moving striations was suspended. Results of previous work suggest the generation of low-frequency oscillations either close to or in, the double sheath at the cathode. Further investigation of this phenomenon is in progress. Experimental work is reported on low-frequency electrostatic sound waves, striations and light fluctuations, fluctuations in a gridded tube, and effects of axial magnetic fields. High-frequency experiments were conducted to investigate dipole resonances and oscillations, other work is reported on diagnostic techniques. (J.R.D.)

31141 (TID-16513) STUDIES OF H_2^+ DISSOCIATION. PHASE II. Quarterly Progress Report No. 3, May 15, 1962 – August 15, 1962. A. W. Ehler (Hughes Research Labs. Div. of Hughes Aircraft Co., Malibu, Calif.). Sept. 6, 1962. Contract AT(04-3)-362. 3p.

The search for spurious sources of ions was completed with several final observations regarding the character of images formed by ions impinging on a fluorescent screen placed on the ion chamber flange. Equipment modifications designed primarily to contribute to a more accurate assessment of the extent to which H^+ ions are formed by gas breakup are described. A rough evaluation of the magnitude of the part of the H^+ ion current due to gas breakup was made. (M.C.G.)

31142 (UCRL-5721) MICROWAVE DIAGNOSTIC SYSTEMS AND TECHNIQUES FOR USE IN CONTROLLED FUSION RESEARCH. Harlin L. Bunn (California. Univ., Livermore. Lawrence Radiation Lab.). June 1960. Contract W-7405-eng-48. 28p.

Microwaves were used for several years at Lawrence

Radiation Laboratory to study conditions in the magnetically contained plasmas of controlled fusion research. There are two basic microwave techniques. One gives information on electron density and distribution in the plasma, the other provides data on electron temperature. The established techniques are summarized, engineering requirements and limitations are discussed, and some further applications of microwaves presently being considered are described. (auth)

31143 (UCRL-6114) NONLINEAR DIFFUSION OF A MAGNETIC FIELD INTO A PLASMA. Edward A. Soltysik (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 1960. Contract W-7405-eng-48. 14p.

By use of the equations of magnetohydrodynamics, the diffusion of a magnetic field into a plasma was calculated. It was assumed that the electrical conductivity σ of the plasma follows a (temperature)$^{\frac{1}{2}}$ power law, and that acceleration effects are negligible. Under these conditions it is shown that the magnetohydrodynamic equations reduce to one nonlinear diffusion equation for the magnetic field. The equation is solved with the help of the IBM-650 computer, and the results are presented graphically and compared with the results for linear diffusion. (auth)

31144 (UCRL-6705-T) SOME OBSERVATIONS OF PLASMA INSTABILITIES IN THE MIRROR MACHINE. Richard F. Post (California. Univ., Livermore. Lawrence Radiation Lab.). June 18, 1962. Contract W-7405-eng-48. 58p.

A discussion is presented concerning complex aspects of plasma studies. A brief review is included concerning the nature of plasma instabilities which might be encountered in mirror machines. Instabilities can be divided into categories such as gross or hydromagnetic instabilities involving the plasma as a whole, and so-called microinstabilities which involve localized turbulence or oscillatory instabilities of the plasma. Plasma regimes which should avoid microinstabilities are described, and discussions of problems associated with such regimes are included. Effects which may ameliorate hydromagnetic instabilities are discussed along with methods of containing hot plasmas. (J.R.D.)

31145 (FTD-TT-62-86) THE SUBDUAL OF PLASMA. Translated from Sovet. Rossiya, No. 242, p.3(Oct. 12, 1961). 5p.

A general review of efforts in the Soviet Union concerning thermonuclear reactor development is presented. No data are included. (J.R.D.)

31146 (UCRL-Trans-833(L)) ON THE KINETICS OF NON-ISOTHERMAL PLASMA. V. P. Silin and L. M. Gorbunov (Akademiya Nauk S.S.S.R. Institut Fiziki im. P. N. Lebedeva). Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from report A-61. 1962. 10p.

Kinetic equations which explain the important effects of collisions with plasma waves are investigated with respect to effects of such interactions on the transfer coefficients of non-isothermal plasma. In a non-isothermal plasma under conditions where the electron temperature T_e considerably exceeds the ion temperature T_i there are possible weakly attenuating acoustical waves. The velocity of such waves turns out to be much greater than the thermal velocity of ions. Therefore, the ions interact weakly with the acoustical waves. For an explanation of the interaction role with acoustical oscillations and for determination of the corresponding effect on kinetic coefficients of a non-isothermal plasma ($T_e \gg T_i$), it is sufficient to take into account the effects of plasma polarization only in the case of collisions of electrons one with another, but for description of the collisions of electrons with ions and ions with ions one can make use of the ordinary integral of collisions in which polarization is disregarded. From the foregoing it is likewise plain that only the contribution in the kinetic coefficients changes form, which is dependent on the electron distribution function. Therefore it is sufficient to limit the investigation to only a kinetic equation for the electrons. (N.W.R.)

31147 THERMONUCLEAR POWER REACTORS. Ernest F. Johnson (Princeton Univ., N. J.). Chem. Eng. Progr., 58: No. 8, 60-4(Aug. 1962).

A comparison is made of various types of blankets for fusion reactors utilizing tritium. The purposes of the blanket are to shield the magnets from the neutrons produced in the reactor and to generate T by neutron reactions (e.g., by $Li^6(n,T)$ or $Li^7(n,nT)$). The blanket consists of a fast-neutron moderator and a slow-neutron absorber. The absorptive properties and tritium transport characteristics are compared for Li metal, Li alloys, Li amide, Li nitrate, Li nitrite, and slurries containing Li and Be oxides with Li and Be nitrates or nitrites. Typical flow diagrams for T recovery and blanket makeup are shown. (T.F.H.)

31148 THE PERFORMANCE OF A MAGNETOHYDRODYNAMIC RE-ENTRY VEHICLE CHANNEL. M. J. Brunner (General Electric Co., Philadelphia, Penna.). Commun. and Electronics, No. 61, 209-16(July 1962).

The performance of a magnetohydrodynamic (MHD) channel is discussed. Solutions of the MHD equations are evaluated through the channel as a function of inlet Mach number, voltage parameter, magnetic-interaction parameter, and channel aspect ratio. The over-all performance of a re-entry vehicle channel throughout the trajectory is described for various vehicle applications as a function of the trajectory, the channel, and the vehicle geometry. Various design aspects are discussed including the coil channel, electrodes, seeding requirements, Hall and ion slip effects. A typical MHD channel and coil design is included. (auth)

31149 CHARGE INTERACTION WITH AN ELECTRON PLASMA IN A MAGNETIC FIELD. A. B. Kitsenko (Technical Physics Inst., Academy of Sciences, Ukrainian, SSR). Doklady Akad. Nauk S.S.S.R., 145: 305-8(July 11, 1962). (In Russian)

The energy loss per unit path length of a charged particle moving longitudinally to an external magnetic field is given by $-(dE/dz) = -\int(\rho/v)\,(vE)\,dr$, where ρ is the charge density, $\underline{v}$ is the velocity of the charge which is assumed to be significantly larger than the thermal velocity of the plasma electrons, and E is the electric field created by the charge in the plasma. The distribution of charge density in a bundle of charges is taken in the form: $\rho = q(\alpha^2/4\pi)\exp(-\alpha|\underline{r} - \underline{v}\underline{t}|)$, where q is the total charge of the bundle, and α characterizes the dimensions of the bundle. The field E can be determined by using the equations of Maxwell and the equations for the motion of an electron "liquid". A friction term is introduced to obtain only slight dampening of the waves. The terms depending on the coordinate $\underline{r}$ and the time $\underline{t}$ follow a plane wave distribution of $\exp i(\underline{k}\underline{r} - \omega t)$. The tensor of the dielectric penetrability is a function of the unit vector in the direction of the external magnetic field, and coefficients depending on the Langmuir frequency, the gyro frequency of the electrons, and the frequency of the "near" collisions. A formula is derived by which the total energy losses of a point charge can be calculated. The energy losses for "close" collisions are calculated separately. A charge passing through a plasma in an external

magnetic field emits ordinary and unusual waves which are radiated out of the plasma. The loss by radiation is comparable to the loss by "near" Coulombic collisions. The frequency of the irradiated waves is given in tabular form. The intensity of the radiation over any interval of frequencies can be readily estimated by the derived formula. The radiation intensity is proportional to the square of the total charge of a bundle, while the energy losses by "near" Coulombic collisions are directly proportional to the charge of the bundle, and are small in comparison to the radiation loss. (TTT)

31150 FLUCTUATIONS IN A PLASMA WITHOUT COLLISIONS. Yu. L. Klimontovich and V. P. Silin (Moscow Univ.). Doklady Akad. Nauk S.S.S.R., 145: 764-7 (Aug. 1, 1962). (In Russian)

Over a wide range of frequencies the relaxation time of the magnetic field is less than the relaxation time of the plasma, and hence, a theory of fluctuations can be developed in which the field is completely determined by the state of the plasma particles. The coulombic interaction of the particles and also the lateral electromagnetic field are taken into account in determining the fluctuations in distribution for a plasma without collisions. The space-time spectral functions for the particle distributions are found without first determining the correlation functions. This procedure considerably simplifies the solution of the problem, especially on taking into account the lateral field. The equations are developed for an isotropic distribution of particles according to momentum in a constant magnetic field. On neglecting the effect of the transverse magnetic field, the formulas correspond to simpler formulas which had been derived previously. The method used simplifies the derivation of a kinetic equation for a relativistic plasma. An expression is given for the collision integral. The simultaneous correlation functions for a nontransparent plasma were derived. (TTT)

31151 SCATTERING OF MICROWAVES FROM A CYLINDRICAL PLASMA IN THE BORN APPROXIMATION. [PART] III. Yukio Midzuno (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1299-1303(Aug. 1962). (In English)

Formulas for the scattered microwaves are derived in the presence of a steady magnetic field oblique to the axis of a cylindrical plasma. The source of the incident wave may be a magnetic dipole or an electric dipole. A lemma is quoted and used to reduce the case of a magnetic dipole source to that of electric dipole sources. Relations among the scattered fields produced by various types of sources are presented, with their possible applications. (auth)

31152 PROPAGATION CHARACTERISTICS OF MAGNETO-IONIC PLASMA COLUMNS. D. Formato and A. Gilardini (SELENIA S.p.A., Rome). J. Research Natl. Bur. Standards, 66D: 543-55(Sept.-Oct. 1962).

The propagation characteristics of uniform, cylindrical plasma columns of circular cross section, in constant axial magnetic fields are determined. The ratios (plasma wave-length)/(free-space wavelength) and (power flowing in the plasma)/(power flowing outside) are evaluated and discussed as functions of the diameter/wavelength ratio and of the plasma permittivity, for propagation of circularly symmetr. al modes. Brillouin diagrams are also derived and compared with the results predicted by the quasi-static approximation. The analysis is carried out for a nonattenuating plasma, but formulas giving the attenuation caused by electron-molecule collisions are also included. (auth)

31153 ON THE RELATION BETWEEN THE MOVING STRIATION AND THE PLASMA PARAMETERS IN A GLOW DISCHARGE. Shiro Hamamura (Hiroshima Univ.). J. Sci. Hiroshima Univ. Ser. A-II, 25: 33-48(July 1961). (In English)

An investigation was made on the dependence of the frequency, the propagation velocity, and the plasma parameters upon the discharge condition. The plasma parameters were measured by means of a movable probe. The principal results obtained are as follows: (1) The frequency is influenced neither by a change of electrode material nor by electrode separation. (2) The change of mode occurs with an increase of the ambient temperature of the discharge tube. (3) The relation between the frequency and the average velocity of the moving striation is almost linear. (4) The relative light intensity is large on the anode side of a range of strong electric field, while, on the contrary, on the cathode side of a strong field range the local velocity is large. (5) The plasma parameters change abruptly with the change of the mode. (auth)

31154 NOTE ON THE INTERRELATION BETWEEN THE MOVING STRIATIONS IN A CROSS TYPE DISCHARGE TUBE. Masaaki Oyasato and Shiro Hamamura (Hiroshima Univ.). J. Sci. Hiroshima Univ. Ser. A-II, 25: 49-53 (July 1961). (In English)

An investigation was made on the coupling between moving striations which are excited spontaneously through a discharge tube of cross type with four cold electrodes. The electric discharge was sustained between either facing or neighboring pairs of electrodes by means of two d-c power supplies which were independent of each other. The interrelation between frequencies of the striations which are observed at several key points is examined under various discharge conditions. Features on the discharge routes are also described. (auth)

31155 PROPAGATION IN A PLASMA FILLED WAVEGUIDE. R. L. Ferrari and A. Reddish (General Electric Co. Ltd., Wembley, Eng.). Nachrtech. Fachber., 22: 7p.(1961).

After an outline of the dielectric properties of magnetized plasma, the dispersion relation for a plasma-filled circular waveguide is derived. Attenuation resulting from collisions is considered, as is Cherenkov radiation. Experimental results are presented for hot-cathode discharges in Ne, Ar, and Kr. (T.F.H.)

31156 NOISE RADIATION AND SCATTERING FROM A CYLINDRICAL PLASMA COLUMN. B. Agdur, B. Keržar, and F. Selberg (Royal Inst. of Tech., Stockholm). Phys. Rev., 128: 1-5(Oct. 1, 1962).

Noise radiation and scattering from a cylindrical mercury discharge plasma at microwave frequencies are studied experimentally and theoretically as functions of the electron density. Measurements are made both in free space and in a waveguide system at different values of the gas density and for different polarizations of the electromagnetic field. (auth)

31157 ON THE NONLINEAR THEORY OF IONIC CYCLOTRONIC RESONANCE. A. N. Kondratenko. Ukrain. Fiz. Zhur., 7: 366-70(Apr. 1962). (In Ukrainian)

An electromagnetic wave of frequency ω close to the ion cyclotron frequency ω_i is propagated along the field in a plasma, which is in a constant magnetic field $H_0 \parallel z$ in a narrow wave-guide. In the linear approximation the velocity of the ions tends towards infinity as $\omega \to \omega_i$. On taking into consideration the nonlinear terms in the approximation of a small nonlinearity a dispersion equation is obtained of the following form as $\beta^2 \to 0$: $\omega = \omega_i [1 - (\omega_{Ni}^2/\omega_i^2)\beta^2 - (k_1^2 u_0^2/4\omega_i^2)]$, where ω_{Ni} is the Langmuir frequency of the ions, $\beta = (v/c)$, k_1 is the component of the

wave vector along the wave-guide radius, and u_θ is the velocity of the ions. The velocity of the ions proves to be finite and has a maximum value equal to $u_{\theta max} = c[4(\omega_i^2/k_z^2c^2) \cdot (E/H_0)^2]$, where E is the amplitude of the electric field intensity of the electromagnetic wave. (auth)

31158 ON WAVE EXCITATION IN A PLASMA MODULATED BY CURRENT. A. N. Kondratenko. Ukrain. Fiz. Zhur., 7: 371-7(Apr. 1962). (In Ukrainian)

A boundless plasma is considered, in a constant magnetic field. A modulated ionic current moves in the plasma, perpendicular to the external magnetic field. To simplify the problem the distortion of the current trajectory in the magnetic field is neglected. A current is considered that moves in a plane that can be oriented either parallel or perpendicular to the magnetic field. In the case of a hydrogen plasma, when the current is parallel to the external magnetic field, the relative energy losses by the current-carrying particles per unit path length proves equal to $2\pi r_i n_0 (\alpha^2\omega_e^2/\omega_{0e}^2)\{\mu^{1/2}/[1-(\omega^2/\omega_i^2)^{1/2}]\}$ $(\omega < \omega_i)$, where r_i is the classical radius of the current-carrying ions and n_0 is their density, $\alpha = (c/v_0)$, v_0 is the current velocity, ω_e is the gyrofrequency of the electrons, ω_{0e} is the Langmuir frequency of the plasma, $\mu = (m_e/m_i)$, m_e and m_i are the mass of the electron and ion respectively, $\omega_i^2 = \omega_i\omega_e$, ω_i is the gyrofrequency of the ions, and $\omega_e^2 << \omega_{0e}^2$. In the case of ionic energy of the order of 100 kev, $(\omega_e^2/\omega_{0e}^2) \sim 0.1$ and $1 - (\omega^2/\omega_i^2) \sim 0.1$. These losses prove to be greater by two orders than those determined by calculations in which low-frequency oscillations are considered and the excitation of the natural frequencies of the plasma is not taken into consideration. (auth)

31159 THE EFFECT OF IRRADIATION ON A CHARGED PARTICLE PASSING THROUGH A MAGNETIC PLASMA. V. N. Tsytovich (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz., 43: 327-9(July 1962). (In Russian)

External radiation of high density, which interacts only slightly with the plasma (region of transparency), can interact strongly with the fast particles passing through the plasma due to induced Cherenkov absorption and emission. Expressions were derived for the induced change in particle energy, and the angle θ of the particle with respect to the magnetic field under the action of external radiation. Here $\theta \ll 1 = v_\perp/v_z$, and v_z, $v_\perp \ll 1$ are the velocity components of the particle along the field, and perpendicularly to the field. The number of quanta $\bar{N}(\omega, k_z, k_\perp)$ of frequency ω and momentum $\underline{k}$ were averaged over an angle $\theta = \text{arctg}(k_x/k_y)$. It is shown that a charged particle is accelerated by external radiation. The critical radiation density, at which the acceleration of the charged particles exceeds the spontaneous Bremstrahlung radiation is 10^{-20} to 10^{-23} ergs/cm^3 in the second Van Allen belt, where electrons of 10^5 to 10^6 ev energy are moving in a gas having a density of 10^3 particles per 1 cm^3. Even radio emissions from the sun can accelerate the fast electrons in a Van Allen radiation belt. Under the most favorable conditions, galactic radio emissions can double the electron energy in a radiation belt within ten days. Heavy ions are accelerated in preference to a light particle by this mechanism. (TTT)

31160 ON THE MAGNETIC FIELD TOPOLOGY. [PART] II. G. V. Skornyakov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 32: 777-81(July 1962). (In Russian)

The stability of magnetic field topology created by surface currents in a toroidal region limited by a smooth superconducting surface was studied. The behavior of plasma in a magnetic field without magnetic surfaces was examined and the topological structure of magnetic traps for confining plasma are discussed. (tr-auth)

31161 ON THE MAGNETOHYDRODYNAMICS OF A QUASI ONE-DIMENSIONAL PLASMA FLOW. [PART] I. Yu. V. Sanochkin and V. S. Erofeev. Zhur. Tekh. Fiz., 32: 782-91(July 1962). (In Russian)

Quasi one-dimensional flow of plasma in crossed electric and magnetic fields was analyzed by magnetogasdynamic approximation for the case of $Re_m \ll 1$. Resolutions were derived for constant drift velocities and isothermal flow at arbitrary cross sections, fields, and flux along the channel. (tr-auth)

31162 PLASMA RESONANCE OF ELECTRONS IN MAGNETIC FIELD. L. V. Dubovoi, A. G. Ponomarenko, and V. A. Kornilov. Zhur. Tekh. Fiz., 32: 792-7(July 1962). (In Russian)

Measurements were made of high-frequency energy absorption in a low-pressure hydrogen discharge in crossed alternating and constant magnetic fields. Absorption resonances in quantitative agreement with theory were found. The measurements are applied in plasma diagnostics and heating. (tr-auth)

31163 PLASMA HEATING IN PRESENCE OF MAGNETOSOUND RESONANCE. V. V. Dolgopolov and K. N. Stepanov. Zhur. Tekh. Fiz., 32: 798-802(July 1962). (In Russian)

Heating of a plasma cylinder by an electromagnetic field with magnetoacoustic resonance was investigated, and it is shown that the spatial dispersion of plasma results in strongly increased absorption of high-frequency energy at the expense of Coulomb collisions. (tr-auth)

31164 ELECTROMAGNETIC WAVE REFLECTION BY MOVING PLASMA. V. I. Kurilko and V. I. Miroshnichenko (Khar'kov Inst. of Physics and Tech.). Zhur. Tekh. Fiz., 32: 803-10(July 1962). (In Russian)

Previous kinetic studies were made of interactions of electromagnetic waves with contained stationary plasma in order to determine the feasibility of h-f plasma confinement and heating or to develop new methods for accelerating charged particles. A further kinetic analysis is made of electromagnetic wave reflections by plasma in motion along a magnetic field, where wave velocities are reduced with a dielectric described by a given ϵ and μ. (R.V.J.)

31165 γ-RADIATION OF A DISCHARGE IN MAGNETIC TRAP WITH ADDITIONAL AZIMUTH MAGNETIC FIELD. Ya. F. Volkov, V. T. Tolok, and K. D. Sinelnikov. Zhur. Tekh. Fiz., 32: 811-16(July 1962). (In Russian)

Gamma emissions produced by fast electron bremsstrahlung in electrodeless discharge plasma were investigated. The presence of an azimuthal field intensified γ emission by a factor of 4 and over and increased energy by factors of 3 to 4. Gamma intensities are analyzed as functions of discharge parameters, and a possible electron acceleration method is discussed. (tr-auth)

31166 CURRENT INSTABILITY OF A POSITIVE PLASMA IN MAGNETIC FIELD. V. L. Vdovin and A. V. Nedospasov. Zhur. Tekh. Fiz., 32: 817-22(July 1962). (In Russian)

Positive column instability of He, H_2, Ne, Ar, and Hg in a magnetic field is calculated using previously developed data on the loss of stability by a positive gas-discharge. The $f(r)e^{i(m\phi+\kappa z-\omega t)}$ type instabilities and radial drift of charged particles to the tube wall appear in magnetic fields exceeding a critical value H_c. (tr-auth)

31167 THE INFLUENCE OF AN EXTERNAL AXIAL MAGNETIC FIELD ON THE DYNAMICAL STABILITY OF

A CYLINDRICAL GASEOUS CONDUCTOR. N. A. Bobyrev and O. I. Fedanin. Zhur. Tekh. Fiz., 32: 823-6(July 1962). (In Russian)

Investigations of the dynamic stability of a plasma cylinder in the presence of a longitudinal magnetic field indicate that an external longitudinal field interferes considerably with stabilization. (tr-auth)

31168 ON THE THEORY OF THE STEP IONIZATION AND RECOMBINATION. L. M. Biberman, Yu. N. Toropkin, and K. N. Uljanov (Moscow Inst. of Power Engineering). Zhur. Tekh. Fiz., 32: 827-34(July 1962). (In Russian)

Probabilities of radiation on electron shock ionization of excited atoms and the probabilities of recombination processes are analyzed. An expression for the coefficient of recombination with emission was developed considering all excitation states of complex atoms. The gradual atomic ionization by electric shock was studied using the Bethe-Born approximation. It is shown that the excited atom ionization is of paramount importance in near equilibrium plasma. Recombination by triple shock (ion + 2 electrons) is gradual. Expressions were developed for ionization and recombination coefficients. It was also revealed that the results are not sensitive to the initial effective cross sections. (R.V.J.)

31169 MOTION AND SCATTERING CROSS SECTION OF ELECTRONS IN WEAK IONIZED CESIUM PLASMA. N. D. Morgulis and Yu. P. Korchevoii (Kiev State Univ.). Zhur. Tekh. Fiz., 32: 900-3(July 1962). (In Russian)

The motion and scattering cross section of electrons in weakly ionized plasma were studied using cesium vapor discharge. Electron scattering in cesium vapor at various temperatures is discussed. (R.V.J.)

31170 BALL LIGHTNING. Donald J. Ritchie, comp. (In English Translation). New York, Consultants Bureau, Inc. 1961. 70p. $12.50

Seven papers are included, five of which were previously abstracted in NSA. The previously abstracted papers are on ball lightning, magnetohydrodynamic equilibrium, and the behavior of conducting gaseous spheres in electromagnetic fields. Separate abstracts were prepared for two papers. (J.R.D.)

31171 ELECTRODELESS DISCHARGES AND SOME ALLIED PROBLEMS. George I. Babat (Krzhiyanovskii Inst. of Energetics, Academy of Sciences, USSR). p.17-27 of "Ball Lightning." New York, Consultants Bureau, Inc., 1961.

Electrodeless discharges in high-frequency electromagnetic fields were examined under conditions where the ratio of linear dimension (l) of the discharge space to the electromagnetic wavelength (λ) in air was $10^{-3} < l/\lambda < 10^{-1}$, at frequencies between 10^8 and 10^9 C/s. It was found that when the ratio l/λ is less than 10^{-1} the electrodeless discharges in air at atmospheric pressure may exist at distances of the order of centimeters from the current-carrying electrodes. With radiators in which the dimension l is greater than λ it is possible to have high concentrations of electromagnetic energy at distances (x) up to l^2/λ. When $l \gg \lambda$ and $l^2 \gg x \lambda$, it is possible for a natural breakdown to occur in electromagnetic rays. (J.R.D.)

31172 MAGNETO-VORTEX RINGS. Yu. P. Ladikov. p.51-60 of "Ball Lightning." New York, Consultants Bureau, Inc., 1961.

An analysis of the magneto-vortex ring as a possible model for ball lightning is presented. Included are analytical discussions of steady-state motion of magneto-vortex rings and stability of plasmoids. (J.R.D.)

31173 SPACE CHARGE DEVICE FOR PRODUCING NUCLEAR REACTIONS. (to Standard Telephones and Cables Ltd.). British Patent 903,870. Aug. 22, 1962.

An electron tube structure is designed which uses a space-charge effect to produce thermonuclear reactions. The structure comprises an evacuated spherical cathode shell, an intermediate spherical control grid inside the cathode and which is 95% open, and a spherical anode shell inside the control grid and which is 99% open. In operation, electrons are emitted by the cathode, travel toward the anode, and oscillate around the center of the anode, creating a virtual cathode. A gas such as H_2, D_2, or T_2 is fed to the interior of the anode and is ionized by collisions with the electrons. Under proper conditions, the positive ions undergo fusion reactions. (D.L.C.)

31174 FREQUENCY CONTROL OF RF HEATING OF GASEOUS PLASMA. E. W. Herold (to U. S. Atomic Energy Commission). U. S. Patent 3,052,614. Sept. 4, 1962.

This invention relates to the heating of gaseous plasma by radiofrequency ion-cyclotron resonance heating. The cyclotron resonance frequencies are varied and this invention provides means for automatically controlling the frequency of the radiofrequency to maximize the rate of heating. To this end, a servo-loop is provided to sense the direction of plasma heating with frequency and a control signal is derived to set the center frequency of the radiofrequency energy employed to heat the plasma. (AEC)

31175 STELLARATOR INJECTOR. Richard F. Post (to U. S. Atomic Energy Commission). U. S. Patent 3,052,617. Sept. 4, 1962.

A method and means are described for injecting energetic neutral atoms or molecular ions into dense magnetically collimated plasma columns of stellarators and the like in such a manner that the atoms or ions are able to significantly penetrate the column before being ionized by collision with the plasma constituent particles. Penetration of the plasma column by the neutral atoms or molecular ions is facilitated by superposition of two closely spaced magnetic mirrors on the plasma confinement field. The mirrors are moved apart to magnetically sweep plasma from a region between the mirrors and establish a relatively low plasma density therein. By virture of the low density, neutral atoms or molecular ions injected into the region significantly penetrate the plasma column before being ionized. Thereafter, the mirrors are diminished to permit the injected material to admix with the plasma in the remainder of the column. (AEC)

31176 GAS DISCHARGE APPARATUS. Peter Clive Thonemann, Robert Carruthers, and Roy John Bickerton (to United Kingdom Atomic Energy Authority). U. S. Patent 3,054,742. Sept. 18, 1962.

A gas discharge apparatus is designed for research on the production of controlled thermonuclear reactions. The apparatus comprises a toroidal vessel for containing a gas and with an insulated joint transverse to its axis, a pulse transformer coupled to the vessel for establishing a pinched and pulsed ring discharge in the gas, and a toroidal winding on the outside of the vessel for setting up a magnetic field in the vessel parallel to the discharge. (D.L.C.)

Shielding

31177 (NARF-62-6T) EXPERIMENTAL DETERMINATION OF NEUTRON FLUX DISTRIBUTIONS IN SLABS AND OF EMERGENT SECONDARY GAMMA RAYS. G. T. Western (General Dynamics/Fort Worth. Div. of General

Dynamics Corp., Fort Worth, Tex.). June 1962. Contract AF33(600)-38946. 117p. (FZK-9-176)

Neutrons were deflected 90° with a carbon reflector onto shield materials of linear and borated linear polyethylene, $ZrH_{1.86}$, Inconel X, BeO, Be, and stainless steel (type 309). The emergent flux of various monoenergetic capture gamma rays was experimentally determined for several thicknesses of each material with a special 3-crystal NaI(Tl) anticoincidence total-absorption gamma spectrometer. Also, the spectrum of neutrons incident upon the shield materials and the flux distribution of thermal neutrons within the material were measured. Neutron spectral and flux distribution data were also obtained for the shield materials positioned in the direct beam of neutrons. Additional data on the relative significance of (n_{th},γ) and $(n,n'\gamma)$ gamma rays produced in various materials, when exposed to the direct beam of neutrons from the ASTR, were accumulated. (auth)

31178 (USNRDL-TR-343) GAMMA-RAY PENETRATION INTO THE COMPARTMENTS OF A LIGHT AIRCRAFT CARRIER. S. Tomoeda, W. E. Kreger, M. B. Hastings, and W. G. Miller (Naval Radiological Defense Lab., San Francisco). July 7, 1959. 70p.

The penetration of gamma rays into compartments of an aircraft carrier from three different radioisotopes was measured. Co^{60} (1.25 Mev), Cs^{137} (0.66 Mev), and Ir^{192} (0.34 Mev) sources were exposed at numerous points on the Flight Deck and air-wall equivalent dosimeters were used to measure dose in two general areas of the ship and at three different deck levels. Average dose rates and transmission factors were calculated by integration of the data to represent the case of uniform contamination at 1 curie per square foot. The average dose rates for the different deck levels ranged from 28 r/hr to 0.93 r/hr for Co^{60}; 12 r/hr to 0.20 r/hr for Cs^{137}, and 4.4 r/hr to 0.06 r/hr for Ir^{192}. Two types of transmission factors were computed. The ratios of the average dose rate found 3.5 ft off each deck to the computed dose rate in air 3.5 ft above the Flight Deck ran from 0.242 to 0.01 for the 3 isotopes in the "A" Section and 0.196 to 0.0017 for the "B" Section. The ratios of the average dose rate found 3.5 ft off each deck to the computed dose rate in air 3.5 ft off the same deck ran from 0.307 to 0.027 for the 3 isotopes in the "A" Section and 0.459 to 0.008 in the "B" Section. (auth)

31179 (USNRDL-TR-373) A CORRELATION BETWEEN THEORY AND EXPERIMENT IN SHIP SHIELDING STUDIES. W. F. Waldorf, Jr. (Naval Radiological Defense Lab., San Francisco). Oct. 13, 1959. 64p.

An attempt was made to correlate the available experimental data on ship shielding with a theoretical method that would allow the hazards from fallout radioactivity deposited on the weather decks of ships to be calculated with a fair degree of accuracy. An analysis of the data from the experiments on the light aircraft carrier, COWPENS, is given along with some very detailed theoretical calculations. The theoretical computations were done on a numerical or "point-by-point" basis, and then integrated to simulate a plane source geometry. The methods of calculation for the absorber path lengths through the various deck thicknesses are discussed. Several conclusions were reached that give confidence that calculations of the shielding effectiveness of the deck plating and extra material present in the form of pipes, beams, and machinery can be calculated by the proper numerical techniques. Some data from some British experiments were used to confirm these conclusions. (auth)

31180 (USNRDL-TR-412) EXPERIMENTAL DATA OF GAMMA-RAY PENETRATION INTO THE COMPARTMENTS OF A LIGHT AIRCRAFT CARRIER. S. Tomoeda, M. B. Hastings, and W. G. Miller (Radiological Defense Lab., San Francisco). Apr. 6, 1960. 108p.

The penetration of gamma rays into compartments of an aircraft carrier from three different radioisotopes was measured. Co^{60}, Cs^{137}, Ir^{192} sources were exposed on the Flight Deck and dosimeters were used to measure dose in two general areas of the ship at three different deck levels. Data of dose distribution are presented for the three sources used and for the different source points considered. Diagrams indicating source positions, detector positions, deck and compartment wall thicknesses, and main structural member specifications are also presented. (auth)

Theoretical Physics

31181 AN ESTIMATE OF THE PERTURBATIONS OF HYPERBOLIC MOTION IN THE THREE-BODY PROBLEM. V. M. Alekseev (P. K. Shternberg State Astronomical Inst., USSR). Astron. Zhur., 5: 841-9(May-June 1962). (In English).

The motion of three gravitating mass points is considered. On the basis of theorems, estimates are made of the perturbations in the relative motion of two bodies when the osculating motion is hyperbolic and initially the distance between the two bodies is either minimal or has a positive derivative. The adopted methods and estimates are effective for cases in which whole classes of trajectories are investigated. (auth)

31182 ON SOME EQUATIONS FOR POTENTIAL SCATTERING. M. Blažek (Lab. of Physics, Slovak Academy of Sciences, Bratislava). Czechoslov. J. Phys., 12: 497-507 (1962). (In English)

It is shown that by solving a given linear integral equation for potential s-scattering one can obtain: in the simplest case, when the scattering matrix S has one redundant pole in the upper half-plane of the impulse—the Bargmann potentials; if the S-matrix has n redundant poles—equations for s-scattering identical to those found using an adapted and simplified Bargmann method; if the S-matrix is discontinuous on a certain interval—the non-relativistic Noyes-Wong equation; and further relations for combinations of isolated poles and discontinuities of the S-matrix on intervals. The former equations can be obtained from the latter as specific cases. The relation between the value of the residuum of the S-matrix in the redundant poles and the number of bound states is shown, and the solution of the inverse problem for a band spectrum is sketched. (auth)

31183 A REMARK ON THE GENERAL PERTURBATION THEORY. J. Koutecký and J. Čížek (Inst. of Physical Chemistry, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys., 12: 567-70(1962). (In English)

General perturbation theory is applied to cases in which the perturbation calculus is based on several characteristic functions of the Hamiltonian. It is shown that this type of application can be used to study chemical-bond and solid-state theories, if the perturbations are localized. (T.F.H.)

31184 NEW RADIOACTIVITY 43-MIN YTTRIUM-84. Toshimitsu Yamazaki, Hajime Ohnuma, Yoshio Hashimoto, Manabu Fujioka, Eiko Takekoshi, Akira Hashizume, Hidetsugu Ikegami, and Mitsuo Sakai (Tokyo Univ.). J. Phys. Soc. Japan, 17: 1223-9(Aug. 1962). (In English)

A 43 ± 2-min yttrium activity is observed in a natural strontium target irradiated with 57-Mev protons. The

activity is assigned to Y^{84} by measuring the excitation function. The 3.7-hr activity previously assigned to Y^{84} is identified to Y^{85}. Gamma transitions of 0.453 Mev (10%), 0.590 Mev (15%), 0.795 Mev (100%, E2), 0.982 Mev (100%, E2), 1.041 Mev (50%, E2 or M1), 1.27 Mev (9%), and 1.47 Mev (6%) are observed in the scintillation and internal conversion spectra of Y^{84}. The positron spectrum taken with a beta-ray spectrometer gives maximum energies of 3.50 ± 0.10 and 2.90 ± 0.15 Mev. Gamma-gamma and positron-gamma coincidence measurements are carried out. A tentative decay scheme is proposed that involves the following energy levels in Sr^{84}: 0.982 or 0.795 Mev (2+), 1.777 Mev (4+), 2.367 Mev, 2.818 Mev, etc. The spin and parity of Y^{84} are tentatively assigned as 5−. (auth)

31185 ON THE HIGH-ENERGY BEHAVIOR OF THE PHOTON PROPAGATOR. Milan Petráš (Comenius Univ., Bratislava). Mat. fyzik. časopis, 12: 129-35(1962). (In Russian)

A method for improving the high-energy behavior of the photon propagator obtained from perturbation theory is proposed. (auth)

31186 EXPANSION OF THE SCATTERING MATRIX IN TERMS OF MULTIPLE IMPULSIVE PERIPHERAL INTERACTIONS. R. E. Cutkosky (NORDITA, Copenhagen). Nuclear Phys., 37: 57-77(Aug. 1962). (In English)

A perturbation expansion is developed for the S-matrix. Each term of the expansion corresponds to a Feynman graph that describes a multiple peripheral collision. The complete effects of the short-range forces are included in the first approximation. The peripheral interaction expansion is based on the analytic properties of the ordinary perturbation expansion and may be looked upon as a rearrangement of the terms of that expansion. It provides a simple perturbation-theory picture for all the concrete results that can be derived by formulating dynamical theories in terms of dispersion relations. The Feynman graphs encountered in the peripheral interaction expansion are those of the ordinary expansion with all self-energy parts omitted. This omission is possible because each line of a graph represents a set of quanta, which corresponds not only to the discrete states, but also to all states lying on the continuum that have a limited angular momentum. Each vertex corresponds to an elementary interaction having a strength equal to the appropriate exact S-matrix element. Renormalization of the successive terms of the peripheral interaction is the most complicated problem encountered, although it is similar to renormalization of the ordinary expansion. In the treatment of this problem, all possible successive graphical contractions are encountered. With the aid of these topological constructions it is possible to state the general renormalization rule concisely. (auth)

31187 RELATIVISTICALLY INVARIANT FORMULATION OF THE THEORY OF QUANTIZED PROBABILITY AMPLITUDE FIELD. Yu. M. Lomsadze (Uzhgorod Univ., Ukrainian SSR). Nuclear Phys., 37: 147-9(Aug. 1962). (In English)

The equation of motion in the quantized probability-amplitude field is put into a manifestly relativistic form, similar to the Tomonaga-Schwinger form in quantized field theory. It is proved that the equation of motion in this form can be solved. (auth)

31188 QUANTUM MECHANICAL LIOUVILLE EQUATION FOR A SYSTEM IN CONTACT WITH A RESERVOIR. Charles R. Willis (Boston Univ.) and Peter G. Bergmann. Phys. Rev., 128: 391-8(Oct. 1, 1962).

The equations of motion satisfied by the density matrix of an arbitrary physical system in contact with an infinite thermal reservoir of quantum mechanical free particles are derived. It is shown that for weak but sustained interactions between system and reservoir, the reservoir is represented by a linear time-independent kernel in the system density matrix space. The kernel is obtained for the three possible models of quantum mechanical free particles which are boson and fermion reservoirs in which the system-reservoir interaction conserves the number of particles of the reservoir and a boson reservoir in which reservoir "particles" may be created or destroyed. In order to derive the equations of motion without using the inconsistent "rerandomization of phases" after each interaction, the Wigner-Weisskopf theory of line broadening of spectral lines is generalized to the equations of motion for the density matrix. It is shown that the kernel preserves the normalization, positive-definiteness, and Hermiticity of the system density matrix and causes the system to approach equilibrium monotonically. In the limit of a classical reservoir the results include a derivation, without the repeated use of random phasing, of Bloch's equations of motion for the density matrix of a spin system imbedded in a thermal reservoir. (auth)

31189 LORENTZ-INVARIANT EQUATIONS OF MOTION OF POINT MASSES IN THE GENERAL THEORY OF RELATIVITY. Peter Havas (Lehigh Univ., Bethlehem, Penna.) and Joshua N. Goldberg. Phys. Rev., 128: 398-414 (Oct. 1, 1962).

After a general discussion of the problem of motion in the general theory of relativity a simple derivation of the law of motion is given for single poles of the gravitational field, which is based on a method originally developed by Mathisson. This law follows from the covariant conservation law for the matter energy-momentum tensor alone, without reference to any field equations, and takes the form of a geodesic of the (unknown) metric. Expanding this metric in terms of a power series in a parameter γ and using the Minkowski proper time to parametrize the world lines of the particles, the (Lorentz-invariant) form of the approximate laws of motion follows. A method is developed to obtain the equations of motion (including the explicit form of the metric in terms of the particle variables) from Einstein's field equations. A systematic linearization procedure leads to a series of second-order differential equations for the metric; the nth order approximation of the equations of motion, as well as the explicit form of the matter tensor in (n + 1)st order, is obtained as an integrability condition on the (n + 1)st order opproximation for the metric. No coordinate conditions are required to obtain the general form of the equations of motion; they are needed only to reduce the approximation equations to wave equations and thus to allow their explicit integration in terms of retarded or symmetric potentials. In developing the approximation method it is shown that consistency requires that any set of approximate equations is solved "up to" rather than "in" nth order; this implies that the form of the lower-order metric be maintained, but the motion corresponding to the nth order solutions rather than to lower order ones. In particular, the equations for the first-order metric imply zero-order equations of motion which restrict the particles to zero acceleration; the equations for the second-order metric imply first-order equation of motion involving the first-order metric, but without the previous restriction. In the retarded case the equations of motion contain retarded interactions and radiation terms of the form familiar from electrodynamics; no such terms appear in the symmetric case. The equations of the symmetric case are derivable from a Fokker-type variational

principle. The relation of the results obtained to work on Lorentz-invariant equations by other authors is discussed. In Appendix I a discussion of alternative derivations is presented; Appendix II contains remarks on Wheeler-Feynman type considerations for general relativistic equations of motion. (auth)

31190 UNITARITY AND HIGH-ENERGY INELASTIC SCATTERING. M. Baker (Stanford Univ., Calif.) and R. Blankenbecler. Phys. Rev., 128: 415-20(Oct. 1, 1962).

The effect of approximately enforcing the unitarity requirement on peripheral collision-type approximations is discussed. A matrix formulation of the Fourier-Bessel representation of the scattering amplitude is utilized which automatically satisfies unitarity at high energies. The results indicate that quantitative agreement of the peripheral collision approximation with experiment can be accidental since the corrections due to unitarity take the same form and magnitude as the phenomenological form factors depending only on the momentum transfer which are introduced to account for "off-mass-shell" effects. Three models are discussed, and one of them has the behavior characteristics of a Regge trajectory. (auth)

31191 IRREVERSIBLE THERMODYNAMICS OF STEADY-STATE PROCESSES. William Bernard (Raytheon Co., Waltham, Mass.). Phys. Rev., 128: 421-34 (Oct. 1, 1962).

An irreversible thermodynamic theory of steady-state processes is derived using quantum-statistical perturbation techniques. The modification of the conventional fluctuation-dissipation theorem of Callen and his co-workers and of the Onsager reciprocity is examined for a system in the nonequilibrium steady state. The principal results are as follows: (1) The instantaneous fluctuation $\Delta J(t)$ of the current from its steady-state average is decomposed into a thermal contribution $\Delta q(t)$ characterizing the interaction of the system with a temperature reservoir and a contribution $\Delta j(t)$ characterizing the additional effects arising from the presence of a steady-state current. (2) The linear response $\phi(t)$ of the system to an applied force, referred to the steady state, and the stready-state current fluctuation moment $\langle \Delta J(0) \Delta J(t) \rangle$ are built up from different combinations of time correlation moments between $\Delta q(t)$ and $\Delta j(t)$. (3) A tentative identification is made of the various contributions to the current fluctuations with thermal noise, shot noise, and generation-recombination noise. (4) The underlying time and magnetic field reversal symmetry of the motion can be destroyed by the presence of a steady-state current, so that the Onsager reciprocity need not, in general, be satisfied. Illustrative applications of the formalism to generation-recombination noise and warm electrons in semiconductors are discussed. (auth)

31192 STABILITY OF THE GRAVITON AGAINST RADIATIVE DECAY. Gerald Rosen (Martin Marietta Corp., Baltimore). Phys. Rev., 128: 449-50(Oct. 1, 1962).

Dimensional and covariance considerations, as well as an examination of the linerized Einstein-Maxwell theory, show that a graviton cannot decay directly into a pair of photons. (auth)

31193 ANGULAR MOMENTA IN RELATIVISTIC MANY-BODY PROBLEMS. B. Barsella (Università, Pisa, Italy) and E. Fabri. Phys. Rev., 128: 451-6(Oct. 1, 1962)

The problem of the splitting of the total angular momentum for a relativistic system of many free particles is discussed, with the aim of justifying the extension to the relativistic case of the usual nonrelativistic techniques. This is done by introducing external (i.e., center-of-mass) and internal (i.e., relative) coordinates and momenta—it being shown that this is always possible, even for particles with spin. The explicit form of the coordinates and momenta is given for the case of two particles, the general case being obtained by recurrence. The arguments leading to the choice of coordinates and momenta are thoroughly discussed; this also gives an unambiguous way to prove that the spins must be transformed into the c.m. reference frame, as is usually done. (auth)

31194 HIGH-ENERGY POTENTIAL SCATTERING. S. Rosendorff (Washington Univ., St. Louis) and Smio Tani. Phys. Rev., 128: 457-67(Oct. 1, 1962).

The asymptotic expansion of the phase shift in inverse powers of the momentum p and the asymptotic expansion of the scattering amplitude in inverse powers of p and the momentum transfer q have been derived for a Dirac and Klein-Gordon particle. It is shown that at high energy (i) the higher-order phase shifts (proportional to α^k, $k \neq 1$, where α is the coupling constant) are very small and negligible in the calculation of the amplitude, (ii) the amplitude approaches the first Born approximation amplitude (linear in α) multiplied by a phase factor. Statement (ii) holds for spherically symmetric potentials V(r) for which the first N derivatives (the phase shift is expanded asymptotically up to p^{-N}) exist for every real positive value of r, including $r = 0$, and for which at least one derivative of odd order does not vanish at the origin. Statement (i) is probably correct also for potentials even at the origin [$V(r) = V(-r)$ for $r \approx 0$]. The upper limit on the coupling constant α is $\alpha \ll p\mu_1$ with the additional condition $p\mu_1 \gg 1$. Here μ_1 is a characteristic length of the potential. The lower limit on the scattering angle θ is given by $\theta \gg (p\mu_2)^{-1}$, where μ_2 is another characteristic length of the potential and is usually of the same order of magnitude as μ_1. The problem of the model independence and other consequences of the theory are discussed. (auth)

31195 THE ANALYTIC BEHAVIOUR OF THE SCATTERING AMPLITUDE. P. J. Bushell. Quart. J. Math. (Oxford) (2), 13: 99-107(June 1962).

It is shown that the analytic nature of the scattering amplitude $f(\underline{k})$ in the upper half of the complex $\underline{k}$-plane is closely related to the analytic nature of a class of functions $q(\underline{z})$ in the first quadrant of the complex $\underline{z}$-plane. The $q(\underline{z})$ functions are defined to be real and continuous for all real non-negative values of $\underline{z}$; to satisfy the condition that there exists a number Θ_0 ($0 < \Theta_0 \leq \pi/2$) such that $q(\underline{z})$ is a regular function of $\underline{z}$ for $0 \leq \arg \underline{z} \leq \Theta_0$ and for $\underline{z} = 0$; and to satisfy specified conditions for $0 \leq \Theta \leq \Theta_0$. It is found that for $q(\underline{z})$'s in this class, $f(\underline{k})$ can be continued into the upper half of the $\underline{k}$-plane and $f(\underline{k})$ is an analytic function of $\underline{k}$ whose singularities lie in the sector $\Theta_0 < \arg \underline{k} < \pi - \Theta_0$. (T.F.H.)

REACTOR TECHNOLOGY

General and Miscellaneous

31196 (ANL-6555) 2D PERT. A TWO-DIMENSIONAL PERTURBATION CODE. J. M. Chaumont and J. A. Koerner (Argonne National Lab., Ill.). May 1962. Contract W-31-109-Eng-38. 61p.

Given multigroup fluxes and adjoint fluxes of any cylindrical R-Z configuration, 2D PERT may compute: the prompt-neutron lifetime; the relative worth of various delayed neutrons; the integrals of capture, fission, etc., of given materials over any given region; local perturbations, i.e., danger coefficients; and integrated perturbations, i.e., reactivity effect of uniform variation in the cross sections affecting a whole region. 2D PERT is programmed for a 32K IBM-704 using 3 tape units. The code is written in FORTRAN with the exception of two SAP subroutines. Input fluxes and adjoint fluxes are on tapes which may be obtained either directly from CUREM output or manufactured by a special tape-writing routine. Homogeneous cross sections and variations of these cross sections are either read in as input information or are computed by the code from a microscopic-cross-section library and atomic densities given as input. A combination of these methods may be used. (auth)

31197 (ANL-6597) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, JULY 1962. (Argonne National Lab., Ill.). Aug. 15, 1962. Contract W-31-109-eng-38. 56p.

Progress is reported on preparation of EBWR for high-power operation, development and operation of Borax-V, research and development on liquid metal reactors including ZPR-III, ZPR-VI, ZPR-IX, EBR-I, EBR-II, and FARET. Developments in general reactor technology are reported in physics, fuels, heat transfer, and chemical separations. Developments in advanced research are reported on reactors and direct conversion devices. Work in the area of nuclear safety is also reported. (J.R.D.)

31198 (ANL-FGF-218) THE ASSEMBLY, SODIUM BONDING AND INSPECTION OF EBR-II BLANKET RODS. R. L. Salley and C. H. Bean (Argonne National Lab., Ill.). Dec. 1960. Contract [W-31-109-eng-38]. 26p. (UAC-4767)

The Experimental Power Breeder Reactor (EBR-II) is a heterogeneous, unmoderated, Na-cooled reactor developed to provide engineering and operational information on full-scale central-station power plants. The enriched U-fissium alloy fuel is blanketed with depleted unalloyed U in type 304 stainless steel tubes. Details of fabrication and loading of these rods are given. (J.R.D.)

31199 (CEND-126) TPF-1—A BOILING WATER REACTOR TRANSFER FUNCTION CODE. E. A. Newburg and F. Rodante (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Mar. 1, 1961. Contract AT(10-1)-967. 24p. (IDO-19027)

A code for use in calculating the magnitude and phase angles for the zero-power feedback, and closed loop transfer functions for models of natural circulation boiling water reactors is presented. The equations represented in the program are Laplace transforms of linearized differential equations describing a reactor model which combines features of various models previously suggested in the reactor literature. The code is limited to processes which occur within the pressure vessel only. The reactivity aspects considered are those caused by voids and fuel temperature Doppler effects. (J.R.D.)

31200 (CEND-160) ABWR QUARTERLY PROGRESS REPORT, APRIL 1–JUNE 30, 1962. DESIGN AND DEVELOPMENT. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). July 2, 1962. Contract AT(11-1)-1062. 17p.

Activities in the program were directed toward reactor development and evaluation in the areas of control rod drive mechanisms, plant simulation, and core evaluation. Other work is reported on PL-2 critical experiments. Data are included on power distributions and reactivity. An analysis of PL-2 core lifetime is also included. (J.R.D.)

31201 (EURAEC-278) HEAT TRANSFER AND STABILITY STUDIES IN BOILING WATER REACTOR. Special Technical Report No. 2. STUDY OF POSSIBLE APPLICATION OF ACOUSTICAL METHODS FOR DETERMINING VOID FRACTION IN BOILING WATER REACTORS. (Eindhoven, Netherlands. Technische Hogeschool). Feb. 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 032-60-11-RDH. 52p.

A survey was made of the acoustical properties of liquid-gas bubble mixtures. The avaible theories were extended to the case of liquid-vapor bubble mixtures. Expressions for speed of sound and damping were derived and numerical values were calculated and plotted. It is shown that it is possible in principle to determine volume fraction of vapor and bubble size distribution from measurements of speed of sound and damping in a mixture as a function of frequency. The method is a sensitive one for small void ratios whereas it is rather insensitive for volume ratios around 50%. The possibilities for application as a measuring technique for determining void fractions in reactors and associated experimental set-ups are discussed. (auth)

31202 (GAMD-2877(Rev.)) CALCULATION OF THE SELF SHIELDING EFFECT OF 237 MICRON DIAMETER ThO_2 GRAINS ON I AND (1/I)(dI/dT) OF AN HTGR CRITICAL ASSEMBLY FUEL ANNULUS. R. K. Lane and J. B. Sampson (General Atomic Div., General Dynamics Corp., San Diego, Calif.). July 6, 1962. Contract AT(04-3)-314. 31p.

The effect of grain self-shielding on I and (1/I)(dI/dT) was determined on the model that thorium is present in oxide grains of uniform spherical form of 237 microns diameter, contained in the "large" type HTGR fuel annulus. The grainyness was found to reduce the resonance integral by 6%, and to slightly increase (dI/dT). (auth)

31203 (GEAP-3882) AEC SUPERHEAT CRITICALS-A COMPARISON OF EXPERIMENT AND THEORY OF UNIFORM LATTICES. G. T. Petersen and F. G. Warzek (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Jan. 1962. Contract AT(04-3)-189. 107p.

A critical experiment program was undertaken to supply the basic physics information, over a wide range of water-to-fuel volume ratios, which is necessary to predict with confidence the nuclear behavior of superheat cores utilizing slightly enriched annular oxide fuel. The experimental measurements included were: critical size, $(\partial\rho/\partial H)$ versus H (ρ = reactivity, H = water height), void coefficient, tem-

perature coefficient, flux distributions, thermal utilization, and conversion ratio. All the measurements were carried out utilizing uniformly spaced arrays of fuel (no controls or water gaps). The experimental results were compared to the prediction of engineering design methods as well as more detailed calculations. Based on these comparisons, a reliable engineering design model was developed for this lattice type. (auth)

31204 (GEAP-3943) CALCULATIONAL MODELS OF NEUTRON DIFFUSION LENGTH EXPERIMENTS IN LIGHT WATER. B. A. Kerr (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). May 27, 1962. Contract AT(04-3)-189. 31p.

The variation of the diffusion length of neutrons in light water as a function of water temperature was calculated and compared with experimental results. Two types of experiments were considered, the thermal-column and the pulsed neutron source experiments. It was concluded that the value of L measured in the thermal column should be about 1.7% higher than the value which results from the pulsed neutron source experiment. (auth)

31205 (GEAP-3946) APPLICATION OF BORON CARBIDE NICKEL DISPERSION TO A PROTOTYPE CONTROL ROD. H. E. Williamson and A. J. Alexander (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). May 1962. Contract AT(04-3)-189. 69p.

Previously reported results on the testing of small samples of boron carbide dispersed in nickel by electrolytic codeposition were adequately encouraging to lead to the development of a prototype control rod for operation in the Vallecitos Boiling Water Reactor. Plates made by this process were used to make a prototype control rod that replaced one of the existing control rods in the Vallecitos Boiling Water Reactor. The results of corrosion and irradiation testing of samples of the prototype absorber material showed that the prototype could be operated safely. The prototype control rod was operated in the Vallecitos Boiling Water Reactor from November 1, 1961, to April 29, 1962. The operation of the control rod was entirely satisfactory, as indicated by the absence of a loss of reactivity, no increase in cobalt and nickel levels in the reactor water, and good visual appearance. Some blistering was noted on the prototype control rod absorber plates, but this did not seem to adversely affect the integrity of the rod. Further irradiation is under consideration. (auth)

31206 (GEAP-4024) NUCLEAR SUPERHEAT PROJECT TENTH QUARTERLY PROGRESS REPORT, OCTOBER–DECEMBER 1961. R. T. Pennington (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Contract AT(04-3)-189. 212p.

Results in the Nuclear Superheat Project are summarized. Topics covered include: conceptual design and program evaluation, fuel technology, materials development, experimental physics, coolant chemistry, heat transfer, mechanical development, SADE and E-SADE, and mixed spectrum superheat study. (M.C.G.)

31207 (HW-57332) HIGH TEMPERATURE HYDRAULIC CHARACTERISTICS OF PRTR FUEL ELEMENTS: 19 ROD CLUSTER AND ROD CONCENTRIC TUBE TYPES. D. R. Doman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 6, 1959. Contract [AT(45-1)-1350]. 15p.

Three types of 19-rod cluster fuel element designs were tested for the Plutonium Recycle Test Reactor. Two were stainless steel clad with NPD reactor type and fittings. One had seventeen stainless steel clad rods and two Zircaloy-2 clad rods. A stainless steel concentric tube element was also tested. High temperature tests conducted at approximate PRTR operating conditions disclosed no problems in the general design of the 19 rod clusters or concentric tube types. Bowing and elongation of wire wraps were observed in assemblies in which the same material was not used throughout. (M.C.G.)

31208 (HW-SA-1946) DEVELOPMENT OF A CONTROL SYSTEM FOR A GAS BALANCED MODERATOR LEVEL CONTROLLED REACTOR. Harold K. Nelson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Aug. 11, 1960]. Contract [AT(45-1)-1350]. 28p.

The development of automatic control systems for nuclear reactors requires a knowledge of the transient and steady state response of the open loop process to various disturbances. The important characteristics of a system can usually be described by a combination of the various gains and phase lags of the system components. Servomechanism analysis and frequency response techniques were frequently used to predict the type and magnitude of control action required to maintain stable and accurate control of a process. An analysis of the Plutonium Recycle Test Reactor by these techniques is presented. Typical results of the analysis work are included along with a discussion of the design objectives for the required automatic controller. The PRTR control system which was finally designed and built is described. (auth)

31209 (HW-SA-2059) PCTR MEASUREMENTS OF EGCR LATTICE PARAMETERS. J. R. Worden, P. F. Nichols, and T. J. Oakes (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Nov. 1960]. Contract [AT(45-1)-1350]. 28p.

The Physical Constants Test Reactor (PCTR) was employed as an experimental support facility in the core design of the Experimental Gas Cooled Reactor (EGCR). The infinite multiplication factors, k_∞, and thermal utilization, f, were measured for the EGCR test lattice with two different fuel enrichments. The resonance escape probability, p^{28}, and fast multiplication factor, ϵ, were also measured for one of the fuel enrichments. The infinite multiplication factor was determined for a supercell consisting of a simulated stainless steel loop tube surrounded by eight lattice cells. The flux peaking effect and the change in k_∞ which occur when the stainless steel spiders are replaced by graphite spiders was also obtained. It was concluded that the PCTR is both economical and reliable in obtaining necessary experimental data in support of the design of a specific reactor system. (auth)

31210 (HW-SA-2508) AN AUTORADIOGRAPHIC STUDY OF RADIONUCLIDE DEPOSITION. Lyle D. Perrigo and W. E. Taylor (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 5, 1962. Contract AT(45-1)-1350. 19p.

A series of autoradiographs were taken of components from an in-reactor carbon steel loop. The results from this study showed finely divided particulate matter carries a significant portion of the coolant-borne activity in a carbon steel recirculation system, the solubility of materials carrying the radioactive matter is temperature dependent, radiation readings along the length of heat exchanger tubes confirmed this conclusion, and particulate matter deposited by a solubility decrease is relatively unaffected by prolonged flushing. Brushing, however, removed appreciable quantities of this deposited material. (auth)

31211 (HW-SA-2644) STARTUP EXPERIENCE WITH THE PLUTONIUM RECYCLE TEST REACTOR. J. C. Fox,

D. J. Foley, and J. F. Fletcher (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [June 15, 1962]. Contract AT(45-1)-1350. 22p.

The Plutonium Recycle Test Reactor has several novel design features which are used for the first time in a U. S. reactor. Of these features, the Zircaloy-2 pressure tubes and reactor control by a gas balance moderator level system were quite successful. Helium pressurization required considerable maintenance and shortened pump seal life during the reactor startup, but its performance has substantially improved. (auth)

31212 (IDO-16762) NUCLEAR START-UP OF THE SPERT II REACTOR WITH HEAVY-WATER MODERATOR. J. E. Grund, T. H. Davis, and R. L. Johnson (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Apr. 20, 1962. Contract AT(10-1)-205. 47p.

A description is presented of the Spert II facility along with a description and the results of the static experiments with the initial D_2O-moderated core to be used in self-limiting power excursion tests. The core is loaded with three-inch square by 24-inch long plate-type, highly enriched uranium–aluminum fuel assemblies on six-inch centers. A core loading of 3.7 kg of U^{235} has an available excess reactivity of approximately $8.1 at 70°F and atmospheric pressure. The temperature coefficient of reactivity varies from about −2.0¢/°F at 80°F to about −4.4¢/°F at 300°F. The reactivity coefficients of temperature and void may be expressed as a density coefficient of −94¢/(per cent density change) for uniform density changes or −7¢/(per cent density change) when confined to the total water volume within the fuel assemblies. The reduced prompt neutron lifetime, l/β_{eff}, was determined to be 0.11 sec. (auth)

31213 (IDO-16787) ORGANIC COOLANT REACTOR PROGRAM QUARTERLY REPORT, JANUARY 1–MARCH 31, 1962. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). June 29, 1962. Contract AT(10-1)-205. 136p.

The possible effects of a H_2 atmosphere in reducing film deposition were studied in the large circulating loop and in rocking cell and pyrolytic capsule tests. At H_2 pressures of 200 to 400 psig no reduction in film weight deposited was observed in the loop tests, and in the pyrolytic tests film deposits were doubled. Heat conductivity of the films was much higher however. In these high ash films the inorganic constituent was found to be α-Fe rather than the usual magnetite, which seems to account for the heat conductivity. Separation of benzene-insoluble material from high boiler and coolant was accomplished by centrifugation and by deposition on glass. The material was closely related to film formation. The nature of the inorganic and organic constituents of this material was examined in several analytical studies. Advances in the techniques of nuclear magnetic resonance, O_2 analysis, measurement of chromatograms, application of computers, and other methods were made. It was demonstrated by use of Fe^{59} that irradiated terphenyl under air attacks Fe rapidly and possibly the Fe is in solution as a chelate or other complex. It also was indicated by some tests that such a soluble form of Fe can figure in the formation of film and of the iron percarbide observed. The program of synthesis of pure samples of polyphenyls neared completion, and the attention was shifted to synthesis of new candidate coolants. Fused-ring structures, partially hydrogenated, such as dihydrophenanthrene were made and proved of interest. Similar studies from the stabilizer investigation indicate the same thing. Other groups in which synthetic activity was initiated are the substituted triazines, pyridines, and other heterocyclic nonbenzenoid types. The industrial coolant candidates from petroleum and coal tar were found to be lacking in thermal stability above 700°F. Only the hydrodealkylated decant oil appeared to have promise for future development. The study of hydrocracking high boiler neared completion. Very good results were obtained using unfractionated coolants, and with the most recent high boiler produced at OMRE. An economic survey of processing high boiler to reclaim coolant is nearing completion. Close technical liaison continued throughout the quarter with AEC-IDO and Fluor Corp on the Title II design of the Coolant Technology Loop (CTL) and the Fuel Technology Loop (FTL). Title I review of the loop handling equipment was completed. The scheduled completion date for the loops is currently being revised. However, procurement of material and equipment is progressing adequately to meet the required dates for field installation. Construction of the Component Development Test Loop (CDTL) was completed and operational shakedown of the loop started. Successful operation at 550°F was realized. Initial operation and testing of a single-stage Chempump in the CDTL showed a high mass transfer of the hot (up to 550°F) pumped fluid from the pump discharge, through the rotor chamber, and back to the pump suction. The necessary parts were returned to the manufacturer for modification. Initial testing of the ball valve has shown acceptable results. A report, IDO-16675, containing complete details of the EOCR control rod latch reliability test was issued. A conceptual design of the FTL nuclear mockup was completed. This mockup will duplicate the nuclear characteristics of the in-pile tube containing a fuel-follower sample for the A-3 core loading. Detailed design of the approach-to-power samples is nearing completion. The eight driver elements being instrumented are D-4, D-6, D-9, D-10, D-11, D-12, D-16, and P-12. These elements were chosen on the basis of coolant flow, flux distribution, core symmetry, and rod programming. A successful run was made demonstrating displacement of Santowax OMP with ethylene glycol from a small model fuel element. Chemical cleaning procedures for the EOCR were tested in a small circulating loop. Fouling tendency tests on Santowax contacting chemically cleaned surfaces will be run. Screening tests have been run in the MTR gamma facility to study the role of free radicals in radiolytic degradation mechanisms. Pyrolytic degradation screening tests have shown the need for impurity control. Design of equipment to study film formation on heated surfaces was completed. Studies were planned utilizing the MTR rabbit facility. A calorimeter was designed to differentiate gamma and fast neutron energy absorption in the EOCR. Apparatus was constructed to perform pyrolytic capsule fouling tests under irradiation. The radiological hazards associated with the operation of the EOCR were analyzed, and the estimated radiation dose rates are presented. It is concluded that operation of the EOCR appears to present no serious hazards. A detailed study of the steady-state heat transfer and hydraulics of the first EOCR operational core was made. The presentation records the calculational methods and the EOCR hot-spot and hot-channel factors, the recommended coolant flow distribution among the fuel assemblies and control rods, and the calculated operating power levels as a function of the fuel-plate hot-spot temperature which is permitted. A two-dimensional burnout study was made on the proposed first EOCR operational core loading, and an operating life of 1200 Mwd or more is expected. EOCR Operations Branch personnel continued to study and

evaluate design and construction of the EOCR. This evaluation and study was directed toward efficient and safe operation of the facility. Representatives of the branch witnessed plant equipment component tests performed by the construction contractor. Testing of an EOCR prototype control rod and check-out of reactor control circuitry continued. Operational planning included the completion (in initial draft form) of portions of the final hazards report and the utilities section of the plant operating manual. Considerable effort was expended in forecasting anticipated needs and initiating design and procurement of various items which will be required for initial operation of the plant. (auth)

31214 (IDO-16788) QUARTERLY TECHNICAL REPORT [ON] SPERT PROJECT, JANUARY–MARCH 1962. F. Schroeder, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Aug. 10, 1962. Contract AT(10-1)-205. 28p.

Integral-core destructive tests were planned for Spert I. The highly enriched, aluminum-clad plate-type core was loaded and a number of static nuclear parameters were measured. The core has a total available excess reactivity of about $8.2 and a shutdown reactivity margin of about $4.4. The average uniform void coefficient of reactivity is about −36¢/% decrease in moderator density and the maximum measured coefficient for voids in the center of the core is approximately −100¢/%. The reduced prompt neutron lifetime measured by analysis of the statistical behavior of the neutron population in the subcritical core is about 8.3 msec. Previously reported calculations were performed to determine if the predicted reactivity compensation resulting from fuel plate expansion and conduction heating of the moderator were adequate to account for the reactivity compensation of the time of peak power inferred from the power data, for non-boiling Spert III power excursions. The discrepancy which was observed led to efforts to further refine the method of calculation. The more accurate method of obtaining the local void coefficient used in the calculations yielded an increase of approximately 20% in the calculated values for the reactivity compensation, but the calculated value was still lower than the experimentally derived value by about 20% at short periods. A method for evaluating the frequency response of a system from its transient response was programmed in FORTRAN for the IBM 650 computer. This program will be used in analysis of excursion data leading toward identification of the physical mechanisms responsible for reactivity compensation. An analog-to-analog data processing method was developed to shorten the time required to obtain quick replots of oscillographic data for operational and test-planning purposes. A complete plant inspection was made to determine the condition of the Spert III coolant system components, after approximately 1600 hours of plant operating time. Only minor defects were noted in the inspection. (auth)

31215 (KAPL-M-SR-1) RKC — REACTOR KINETICS CALCULATIONS. S. A. Ryan (Knolls Atomic Power Lab., Schenectady, N. Y.). July 1962. Contract W-31-109-eng-52. 35p.

The RKC program computes reactor startup transients in the range of reactor power levels where the temperature coefficient effect can be neglected. A constant shim rate and/or a time dependent table is used as a driving function. The code solves the space independent, one energy group reactor kinetics equations with a maximum of six delayed neutron groups. The kinetics equations are programmed in two forms: the first neglects the reactor prompt generation time, τ_0; the second considers it. The arbitrary value of excess multiplication below which τ_0 is to be neglected is an input quantity. (auth)

31216 (LADC-4055) REACTOR COMPUTING. Carroll B. Mills (Los Alamos Scientific Lab., N. Mex.). [1959]. Contract [W-7405-eng-36]. 13p.

Reactor computing techniques which use the basic equations of reactor theory and neutron cross sections are discussed. The results of calculation for some of the most important critical assemblies are shown. Reactor computing methods were found to be useful for development, analysis, and safety applications. (M.C.G.)

31217 (MITNE-12) IRRADIATION LOOP STUDIES OF ORGANIC REACTOR COOLANTS. Quarterly Report, October 1–December 31, 1961. E. A. Mason and W. N. Bley (Massachusetts Inst. of Tech., Cambridge). June 1, 1962. Contract AT(10-1)-1067. 25p. (IDO-11103)

Irradiation of Santowax OMP in the MITR In-Pile Loop continued until the coolant contained 60.4% degradation products (DP). This level of DP was reached with batch irradiation; the batch size was approximately 5000 g. The coolant contained 28% DP after an addition of Santowax OMP. The absorbed dose was 25.2 w-hr/g to a 5000 g charge containing 45% DP at 600°F. The degradation rate for this quarter has not been quantitatively determined, but preliminary evaluation indicates no large difference from the values reported in the last quarterly report. The major emphasis this quarter was placed on completing a statistical evaluation of the coolant composition analyses and physical property data for the first phase of the irradiation. At a given % DP, the density and viscosity measured after dilution were found to be approximately 10% higher than the density and viscosity measured prior to dilution. Using the experimental values of the density and viscosity in the Dittus-Boelter equation, the heat transfer coefficient for coolant containing 60 wt. % DP can be predicted within the range +15% to −5%. During the period the test heater was inadvertently fouled when flow was drastically reduced while repairing a turbine flowmeter. The heat flux was approximately 200,000 Btu/hr-ft^2 at the time, but the maximum wall temperature is not known. The coolant contained 44.5 wt. % DP at the time fouling occurred. Subsequent heat transfer measurements indicated that the fouling did not increase as the irradiation progressed. The "Wilson" method of plotting the total resistance to heat flow as a function of $1/V^{0.8}$ to determine scaling or fouling resistances indicated that the overall heat transfer from the inner tube wall to the bulk fluid decreased by a factor of two. When the test heater was replaced, the heat transfer results obtained were the same as those of the first heater before it was fouled. The neutron dose rate to Santowax OMP calculated from the measured neutron spectrum in the stainless steel mockup thimble was 0.128 w/g at the reactor midplane. This value compares favorably with the value of 0.121 w/g determined from calorimetric measurements. (auth)

31218 (NASA-TN-D-1434) MONTE CARLO CALCULATIONS OF NEUTRON NUMBER SPECTRA AND BUILDUP FACTORS IN INFINITE CONICAL CONFIGURATIONS. Millard L. Wohl (National Aeronautics and Space Administration, Lewis Research Center, Cleveland). Sept. 1962. 20p.

A Monte Carlo code simulating neutron transport in infinite cones of water and water-equivalent hydrogen was prepared for an IBM 704 computer. The code was essentially a modification of the point-source, infinite-medium code used in NASA TN D-850. Studies were made of differential neutron number spectra and associated buildup factors for infinite cones having apex half-angles of 15,

30, 45, and 60°. The buildup factors obtained were compared with those for the appropriate infinite medium, which allowed an examination of the effect of solid angle subtended by material on the transport of 6-Mev source neutrons emanating from the cone apex. The variation of number buildup factor with distance for the various cones shows that neutron scattering out of the cones is predominant in the first 30 to 40 centimeters of material, and that transport beyond this distance is of a similar nature in all the cones. (auth)

31219 (NYO-2680) HETEROGENEOUS REACTOR CALCULATION METHODS. Final Report, April 1, 1959–June 30, 1961. Carl N. Klahr, Lawrence B. Mendelsohn, and Jerome Heitner (TRG, Inc., Syosset, N. Y.). June 30, 1961. Contract AT(30-1)-2375. 218p. (TRG-129-FR)

The application of heterogeneous (small source) reactor physics calculation methods to practical core configurations of loosely-packed lattices is reported. The feasibility and economy of digital computer calculations based on heterogeneous reactor physics is demonstrated. Calculations are carried out for a number of problem areas in reactor physics in which solutions are difficult or impossible by other methods, e.g., spiked lattices, and control rod placement effects. Heterogeneous reactor physics is generalized to include fission at resonance energies and non-thermal reactors. New methods are given for evaluation of fuel and control element parameters. New methods are given for calculation of the kernel functions. (auth)

31220 (NYO-10094) QUARTERLY PROGRESS REPORT ON EVALUATION OF AUTOMATIC FLOW BALANCING DEVICE IN BOILING WATER REACTORS, MARCH–AUGUST 1962. Report No. 325. R. L. Mela, R. Moissis, E. D. Doyle, and N. A. Radovcich (Dynatech Corp., Cambridge, Mass.). Aug. 1, 1962. Contract AT (30-1)-2907. 30p.

Two-phase venturi experiments were performed and data were correlated using an analytical model incorporating slip velocities. Components of the flow control system were evaluated and brought up to date. Description of the experimental test loop, hydrodynamic stability studies, and planned experimental schedule are included. (auth)

31221 (TID-6135) RELIEF AND SAFETY VALVES FOR NUCLEAR SERVICE. Bert S. Kosut (Knolls Atomic Power Lab., Schenectady, N. Y.). Apr. 26, 1960 Contract [W-31-109-eng-52]. 21p.

A review of developmental work on relief and safety valves for use in pressurized water nuclear power plants is presented. Included are discussions of valve materials, mechanisms, and corrosion. It is noted that industry has produced components having the prime requisites of reactor systems such as dependable response characteristics. However, further work is needed to improve irradiation stability, and to improve mechanical and thermal properties of materials used in such components. (J.R.D.)

31222 (TID-12402) DEVELOPMENT OF METHODS FOR THE REFABRICATION OF EBR-II FUEL ELEMENTS. PART I. ENGINEERING CONSIDERATIONS FOR EBR-II FUEL REFABRICATION. A. B. Shuck and J. E. Ayer. PART II. DEVELOPMENT OF INJECTION CASTING METHODS AND EQUIPMENT. H. F. Jelinek and G. M. Iverson. PART III. DEVELOPMENT OF FUEL PIN PROCESSING METHODS AND EQUIPMENT. N. J. Carson, Jr. and S. B. Brak. PART IV. ASSEMBLY, WELDING, AND LEAK TESTING EBR-II FUEL RODS. PART V. SODIUM BONDING AND BOND TESTING EBR-II FUEL RODS. T. C. Cameron and N. F. Hessler (Argonne National Lab., Ill.). Feb. 1961. Contract [W-31-109-eng-28]. 14p. (UAC-5003)

The development of remote fabrication methods and equipment in which the cooling periods, chemical fission product separation, and complete decontamination of the fuel is not required is discussed. A process designed around precision casting in multiple, glass molds served as a basis for design of refabrication equipment. The injection casting process is used. Procedures and equipment were developed for the remote manufacture of right-cylindrical, uranium alloy fuel pins from the castings. Assembly, welding, and leak testing of the EBR-II fuel rods are described. Methods of sodium bonding and bond testing are described. (M.C.G.)

31223 (TID-12751) HIGH TEMPERATURE POISONS. J. M. Leitnaker, N. H. Krikorian, and M. G. Bowman (Los Alamos Scientific Lab., N. Mex.). [1961]. Contract [W-7405-Eng-36]. 18p. (LADC-4676)

A discussion of potentially useful high-temperature poison systems for reactors is presented. The desirable properties in addition to favorable neutron capture include high melting points, low vaporization rates, mechanical stability, and chemical stability. The borides of transition metals of the IV and V groups and some rare earth oxides appear to be most interesting. (J.R.D.)

31224 (UCRL-5682(Suppl.1)) 9-ZOOM—A ONE DIMENSIONAL, MULTIGROUP, NEUTRON DIFFUSION THEORY REACTOR CODE FOR THE IBM-709. S. P. Stone (California. Univ., Livermore. Lawrence Radiation Lab.). July 12, 1960. Contract [W-7405-eng-48]. 2p.

The LRL 9-ZOOM code was modified to solve the configuration of a series of stacked cylindrical disks. It was thoroughly checked on an IBM 7090 computer with all possible combinations of low and high density tapes. A number of internal programming changes were made to increase the running time per problem. The use of the heading card was changed. (M.C.G.)

31225 (UCRL-6287-T) THE NATURE OF BOILING WATER REACTOR INSTABILITY. Joseph A. Fleck, Jr. (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 16, 1961. Contract W-7405-eng-48. 6p.

The nature and causes of boiling water reactor instability are discussed. The distinction between feedback and hydraulic instabilities is outlined. (M.C.G.)

31226 (EURAEC-270) INTRODUCTORY LABORATORY STUDIES OF BOILING WATER REACTOR STABILITY. Special Technical Report No. 1. C. L. Spigt, J. P. Simon Thomas, and M. Gogaardt (Eindhoven, Netherlands. Technische Hogeschool). Oct. 1961. Work Performed under United States–Euratom Joint Research and Development Program. Contract 032-60-11-RDH. 39p. Translation of WW/R-10.

Results are given of natural circulation experiments in the pressure range of 0 to 30 kg/cm^2 and 0 to 200 kw power dissipation of a fuel rod dummy identical in dimensions with the fuel rod used in the Halden heavy water boiling reactor (Norway). Slip ratios and two-phase pressure drop values are reported and compared with data obtained by other investigators. In a number of natural circulation calculations the effect of variations in subcooling and slip ratio is shown. The importance of accounting for the axial power distribution is also indicated. Attention was also given to the on-set of instabilities in the natural circulation loop. An outline is given of the subsequent experimental program. (auth)

31227 THEORETICAL STUDIES ON THE SELF STABILITY AND INTERNAL FEEDBACK TRANSFER FUNCTIONS OF BOILING WATER REACTOR. Tsuneaki Hamaguchi (Kawasaki Dockyard Co., Ltd., Kobe, Japan). Bull. Inst. Chem. Research, Kyoto Univ., 40: 97-129(May 1962). (In English)

Analytical expressions for internal feedback transfer functions of a boiling reactor, taking the local effects of both the void and the fuel temperature feedbacks on reactivity into consideration, were established in the range of linear mathematical treatments for a model with the power densities being distributed spatially and the inlet velocities of feedwater being given as a function of radial locations. Special attention is given to the transient fluctuations of the local void fractions which depend upon the generation and movement of the steam bubbles generated by the heat once transmitted to the coolant. The effects of the thermodynamic properties of the moderator on the self regulative characteristics of boiling reactor were also obtained in a form of inequality dominating the limitation on the absolute value of the void coefficient of reactivity. Moreover, the power transfer function of EBWR under the operational conditions of 50 Mw was computed numerically, by using the reactor parameters concerned and the formulas obtained. (auth)

31228 ON THE CALCULATION OF THE EFFECTIVE RESONANCE SURFACE. G. B. Zorzoli (CISE, Milan). Energia nucleare (Milan), 9: 462-6(Aug. 1962). (In English)

A new way of formulating the effective resonance surface is described. Such a way, based upon collision probabilities only, leads to an expression which is compared with a previously utilized formula. (auth)

31229 THE CASE FOR SMALL REPROCESSING PLANTS. Cyril M. Slansky and John A. McBride (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics, 20: 43-7 (Sept. 1962).

Small reprocessing plants of capacity ≤0.3 ton U/day each would encourage industrial competition in this heretofore closed field, and it is shown that the reprocessing cost would be competitive with the AEC reference plant (1 ton U/day) if the investment is amortized over long times characteristic of the electric power industry. Two such small plants built for $5 million each could recover all the low-enriched fuels in U. S. for the next 5 to 10 years. Design features of a small plant are described and compared with a large plant. Estimated unit reprocessing costs are tabulated for the proposed (Phillips) small plant, the Eurochemic plant, the du Pont study for 1- to 10-ton U/day plants, the Allis-Chalmers Italian plant, and the AEC reference plant. The economics of small plants and the various factors affecting the profit are discussed in detail. Finally, plants for reprocessing enriched U fuels are considered. (D.L.C.)

31230 ENGINEERING HOT-CHANNEL FACTORS FOR OPEN-LATTICE CORES. Harold Chelemer and Long Sun Tong (Westinghouse Electric Corp., Pittsburgh). Nucleonics, 20: 68-73(Sept. 1962).

Each of the total hot-channel factors for heat flux, film temperature drop, and enthalpy rise is the product of a nuclear hot-channel factor and an engineering hot-channel factor. A table of the subfactors (fabrication tolerances and flow conditions) contributing to the total engineering hot-channel factors is presented for a open-lattice rod bundle, the fabrication tolerances being treated statistically. The procedures for obtaining the subfactors are examined in detail. (D.L.C.)

31231 STATUS OF THE APPLICATION OF NUCLEAR REACTORS IN THE PROCESS INDUSTRY. Robert W. Ritzmann (U. S. Atomic Energy Commission, Washington, D. C.). Preprint Paper No. 33. New York, Engineers Joint Council, 1962. 19p.

The current status of technology of low-temperature process heat reactors, high-temperature process heat reactors, neutron-, γ-, and β-induced reactions, and fission-fragment induced reactions is summarized. The results of present and potential cost studies for producing low-temperature process heat and potential cost studies for producing fixed nitrogen by nuclear reactors are presented. (auth)

31232 IMPROVEMENTS IN AND RELATING TO MEANS FOR ASSISTING HEAT TRANSFER BETWEEN A SURFACE AND A FLUID. Joseph Maughan (to C. A. Parsons and Co. Ltd.). British Patent 904,140. Aug. 22, 1962.

A finned heat transfer surface for reactor fuel elements is designed which maintains the desired flow pattern over the whole surface. The surface is as described in British Patent 847,214, e.g., it has helical fins interrupted by baffles, but some of the fins at spaced intervals are made higher than the other fins, thereby impeding the fluid from flowing over the tips of the fins. (D.L.C.)

31233 METHOD AND APPARATUS FOR THE PNEUMATIC-HYDRAULIC CONTROL OF NUCLEAR REACTORS. Peter Dosch, Julius Schierenbeck, and Heinrich Schultz (to Kernreaktor Bau-und Betriebs-Gesellschaft G.m.b.H.). British Patent 904,331. Aug. 29, 1962.

A pneumatic-hydraulic reactor control system is described which is extremely simple to operate. In this system, a neutron-absorbing member is floated in a column of liquid in the moderator, and its depth of immersion in the moderator is varied by adjusting the liquid level within and/or outside the floating member. Several embodiments of the system are described. (D.L.C.)

31234 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Leslie Mark Wyatt (to United Kingdom Atomic Energy Authority). British Patent 904,438. Aug. 29, 1962.

A reactor fuel element is designed with means for reducing excessive temperatures at the ends due to neutron-flux peaking. The fuel element is of conventional construction with a fuel member, a finned sheath, and means for stacking such fuel elements in a vertical column, but the ends of the fuel member are terminated with breeder material such as depleted U which absorbs neutrons without fission and thereby lowers the temperature. (D.L.C.)

31235 FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Sulzer Freres, Societe Anonyme). British Patent 904,618. Aug. 29, 1962.

A reactor fuel element of the type comprising a plurality of fuel tubes in a covering tube with one end closed, is designed for improved heat transfer. The coolant is caused to flow first between the fuel tubes and then to reverse its direction to flow back through the inside of the fuel tubes. The tubes may be subdivided for easy replacement of spent tubes. (D.L.C.)

31236 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Roderick Taylor (to Nuclear Power Plant Co. Ltd.). British Patent 905,346. Sept. 5, 1962.

A moderator core structure for a gas-cooled, graphite-moderated reactor is described which allows the core to expand or shrink under irradiation. In this structure, the distances between the axes of the core blocks are con-

trolled by pin spacers arranged in a horizontal plane in mutually perpendicular directions. The structure is a modification of that described in British Patent 899,078. (D.L.C.)

31237 IMPROVEMENTS IN OR RELATING TO FLUID-COOLED HETEROGENEOUS NUCLEAR REACTORS. James Lewis Ayre (to Simon-Carves, Ltd. and General Electric Co. Ltd.). British Patent 905,645. Sept. 12, 1962.

Two methods are given for reducing the possibility of levitation of fuel sleeves from the channels of gas-cooled reactors by coolant flow. One method comprises forming recesses in the channel walls in the region of the uppermost fuel sleeve of a stack so that the coolant flow is bypassed around this sleeve. The other method comprises removing the circumferential projections from the uppermost sleeve to prevent restriction of the space in this region. The fuel sleeves are of the type described in British Patent 879,902. (D.L.C.)

31238 IMPROVEMENTS RELATING TO PRESSURE VESSELS. Ronald Hugh Campbell (to United Kingdom Atomic Energy Authority). British Patent 905,684. Sept. 12, 1962.

A pressure vessel arrangement for gas-cooled reactors is described which allows the functioning of fire-suppressing equipment in the event of reactor depressurization. An impervious membrane with a pervious support backing which makes the membrane more resistant to rupture by egress than by ingress, is adapted to seal a passageway in the pressure vessel, preferably a coolant-sampling pipe. A source of fire-extinguishing liquid, preferably borated water, is connected to the passageway. (D.L.C.)

31239 IMPROVEMENTS IN OR RELATING TO CONTAMINATION DETECTION ARRANGEMENTS. Roland Cochinal, Andre Roguin, and Rene Danguy (to Commissariat à l'Énergie Atomique). British Patent 905,892. Sept. 12, 1962.

A switching device is designed for detecting sheath fractures in heterogeneous reactors. In this device, the cooling ducts of the reactor are connected in sets and the sets in groups, with a primary detector for each group. Each set has a sampling circuit common to all the ducts of that set, and the sampling circuits in each group are arranged to be successively diverted to the primary detector in response to a single instruction transmitter. When an irregularity is discovered in a set, each duct in that set is successively examined by a supervisory detector. (D.L.C.)

31240 HOMOGENEOUS NUCLEAR REACTOR. (to Allmanna Svenska Elektriska Aktiebolaget). British Patent 905,946. Sept. 12, 1962.

A homogeneous reactor of the core-blanket type is designed which combines the advantages of two-zone and one-zone reactors. The reactor comprises an internal core zone, an external blanket zone surrounding the core zone, and an intermediate space between the two zones for transfer of material between the zones. Means are provided for separating the core-blanket liquid mixture into a pure solution and a dispersion and for concentrating the respective liquids and returning them to the zones. Thus, solid fission and corrosion products are led from the core zone to the blanket zone, while newly formed fissile material in the blanket zone is passed to the core zone. (D.L.C.)

31241 MEANS FOR THE PROLONGED STORAGE OF DAMAGED ACTIVE FUEL ELEMENTS OF NUCLEAR REACTORS. (to Allmanna Svenska Elektriska Aktiebolaget). British Patent 906,130. Sept. 19, 1962.

A device for the prolonged storage of damaged fuel elements from a reactor is designed with means for preventing generated steam from reaching the charging machine while an element is being loaded into the storage container. The device comprises an inlet assembly for feeding elements into a water-filled space, a revolving disk with openings for storage pots, and valve means for preventing steam from passing from the store space. When an element is being inserted into the space, the water level is also lowered. (D.L.C.)

31242 NUCLEAR REACTOR FUEL ELEMENT HAVING A THERMOCOUPLE JUNCTION WITHIN ITS SHEATH. Piyatilleke Perera Guneratne, Melville Young, and George Henry French (to United Kingdom Atomic Energy Authority). U. S. Patent 3,051,641. Aug. 28, 1962.

An arrangement is described for bringing a thermocouple into close thermal contact with a fuel element sheath without welding or brazing. In this arrangement, the radially finned sheath has a single eccentric fin root formed between two fins near the cap on the base of the fuel element, and a hole is drilled in the fin root so that the minimum thickness between the hole and the inner sheath surface is the same as the normal sheath thickness. A thermocouple cable with its end deformed is force-fitted into the hole. (D.L.C.)

31243 HETEROGENEOUS NUCLEAR REACTOR FUEL ELEMENT CHARGING AND DISCHARGING MEANS. Kenneth Henry Dent (to United Kingdom Atomic Energy Authority). U. S. Patent 3,051,642. Aug. 28, 1962.

A charge-discharge device is designed for servicing a large number of fuel channels in a pressurized gas-cooled graphite-moderated reactor. The device comprises a pillar with a locating spigot at one end and a rotatable chute at the other end for locating the pillar at the lower end of a charge tube. A second chute is provided which is coupled with the rotatable chute and is pivotted at the coupling so that its lower end is movable radially outwards from the pillar. (D.L.C.)

31244 METHOD AND APPARATUS FOR CONDUCTING A NUCLEAR CHAIN REACTION. Eugene P. Wigner, Lee A. Ohlinger, Gale J. Young, and Alvin M. Weinberg (to U. S. Atomic Energy Commission). U. S. Patent 3,052,613. Sept. 4, 1962.

A nuclear reactor is designed incorporating a slurry of uranium-containing particles in heavy water and including means for circulating the slurry and for cooling the slurry. (AEC)

31245 NUCLEAR FLASH TYPE STEAM GENERATOR. F. L. Johns, E. C. Gronemeyer, and M. R. Dusbabek (to U. S. Atomic Energy Commission). U. S. Patent 3,052,615. Sept. 4, 1962.

A nuclear steam generating apparatus is designed so that steam may be generated from water heated directly by the nuclear heat source. The apparatus comprises a pair of pressure vessels mounted one within the other, the inner vessel containing a nuclear reactor heat source in the lower portion thereof to which water is pumped. A series of small ports are disposed in the upper portion of the inner vessel for jetting heated water under pressure outwardly into the atmosphere within the interior of the outer vessel, at which time part of the jetted water flashes into steam. The invention eliminates the necessity of any intermediate heat transfer medium and components ordinarily required for handling that medium. (AEC)

31246 REACTOR CONTROL DEVICE. Richard H. Graham (to U. S. Atomic Energy Commission). U. S. Patent 3,052,616. Sept. 4, 1962.

A wholly mechanical compact control device is designed for automatically rendering the core of a fission reactor subcritical in response to core temperatures in excess of the design operating temperature limit. The control device comprises an expansible bellows interposed between the base of a channel in a reactor core and the inner end of a fuel cylinder therein which is normally resiliently urged inwardly. The bellows contains a working fluid which undergoes a liquid to vapor phase change at a temperature substantially equal to the design temperature limit. Hence, the bellows abruptly expands at this limiting temperature to force the fuel cylinder outward and render the core subcritical. The control device is particularly applicable to aircraft propulsion reactor service. (AEC)

31247 COOLING SYSTEMS FOR NUCLEAR REACTORS. Ronald Scott Challender and August Roumph (to United Kingdom Atomic Energy Authority). U. S. Patent 3,053,746. Sept. 11, 1962.

A re-entrant coolant circuit for graphite-moderated, liquid-sodium-cooled reactors is designed with means for controlling the coolant flow rate. The coolant passes from the cold sodium tank through two ports in outer and inner tubes into the annular space between the tubes, through the inner tube past the fuel elements, and thence out into the hot sodium tank. Control of the coolant flow rate is effected by rotation of the inner tube to vary the overlap of the ports. (D.L.C.)

31248 PROCESS OF NUCLEAR FISSION. Marie E. A. Hermans and Theo van der Plas (to Stichting Reactor Centrum Nederland). U. S. Patent 3,054,738. Sept. 18, 1962.

A process is given for separating fission products from the fuel suspension used in a homogeneous reactor. The process comprises adding an adsorbent material to the suspension, separating the adsorbent with sorbed fission products from the suspension, and adding fresh adsorbent. The adsorbent is preferably granular active carbon. (D.L.C.)

31249 NUCLEAR REACTOR CONTROL ASSEMBLIES. John Tatlock and John Alexander Forbes Glass (to United Kingdom Atomic Energy Authority). U. S. Patent 3,054,741. Sept. 18, 1962.

A fast reactor core support is designed with means for inserting and withdrawing fissile material for control purposes. The support comprises star-shaped fuel element support and locating plates, inner and outer skirts, division plates for dividing the spaces between the skirts into sectors, and means for moving control fuel element carrier frames into and out from the sectors. (D.L.C.)

Power Reactors

31250 (APAE-Memo-312) SPECIFICATIONS AND FABRICATION PROCEDURES FOR TYPE 3 NEUTRON ABSORBER SECTIONS. E. C. Edgar and H. R. Clayton (Alco Products, Inc., Schenectady, N. Y.). Apr. 25, 1962. Contract AT(30-1)-2639. 59p.

The specification contains information concerning the material, process, and product requirements to be met by the fabricator. (J.R.D.)

31251 (CEND-124) STREAC — A BOILING WATER REACTOR THERMAL AND HYDRAULIC CODE. E. P. Hunger, L. C. Noderer, and F. Rodante (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Mar. 1, 1961. Contract AT(10-1)-967. 47p. (IDO-19025)

STREAC is an IBM-704 code designed to calculate the steady-state thermal and hydraulic behavior of one-pass natural circulation boiling reactors. Given the power distribution along the axis of each box in a multichannel reactor under the assumption of axial and radial power separability, the code yields steam void distributions, inlet velocities, and pressure drops for each box. Further information is also obtained on pressure differentials and velocity behavior for the worst channel when the power is increased. In addition, input water number densities can be obtained for nuclear calculation. (auth)

31252 (CEND-125) REACTOR THEORY DEVELOPMENT PROGRAM FOR ABWR. Final Report. E. A. Newburg and L. C. Noderer (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Mar. 1, 1961. Contract AT(10-1)-967. 29p. (IDO-19026)

In transient calculations, an investigation of the suitability of Lanczos τ method and Galerkin's method is reported. Comparisons of efficiencies for cases involving ramp reactivity function are included. Publication of TPF-1 code, which treats in a linearized fashion the amplitude and phase response to an oscillating reactivity, is reported. The STREAC code used to obtain void distributions, pressure drops, velocities, and stability criteria for natural circulation boiling water reactors is discussed. Other activities during the period are reviewed and recommendations for future development are given. (J.R.D.)

31253 (DP-765) HEAVY WATER MODERATED POWER REACTORS. Progress Report, July 1962. R. R. Hood and L. Isakoff, comps. (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). Aug. 1962. Contract AT(07-2)-1. 30p.

Various modifications were made to the Heavy Water Components Test Reactor (HWCTR) to preclude the formation of undesired gas voids in the moderator space of the reactor during operation at power. Final preparations were made for the initial operation of the reactor at power with no test fuel elements in the core. Good agreement was obtained in a comparison of data from the Process Development Pile (PDP) and the Pawling Lattice Test Rig (PLATR) on the nuclear reactivity of heavy water lattices of natural UO_2 rods. Fabrication was completed on twelve Zircaloy-clad tubular specimens of U–350 ppm Fe–900 ppm Al for capsule irradiations at Savannah River. The free gas contents of five Zircaloy-clad tubes of compacted uranium oxide were measured after the tubes were irradiated at Savannah River. (auth)

31254 (GEAP-3784) DEVELOPMENT OF PROCESS TUBES FOR NUCLEAR SUPERHEAT APPLICATIONS. E. L. Esch (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 15, 1961. Contract AT(04-3)-189. 64p.

Economic feasibility of thermal spectrum superheated steam power reactors is predicted, among other factors, on the development of a satisfactory process tube. Process tubes, which separate the superheated steam from the boiling water moderator, must: be strong enough to withstand transient differential pressures at operating pressures, have a low neutron absorption cross-section, be associated with low fabrication costs, and have good chemical stability in high temperature steam. Two basic concepts were investigated during the course of the development effort; both appear to have good potential for application in water moderated, superheated steam reactors. (auth)

31255 (GEAP-4016) CONCEPTUAL DESIGN FOR A 75 MWe MIXED SPECTRUM SUPERHEATING REACTOR POWER PLANT. G. V. Brynsvold, K. Hikido, A. B. Reynolds, and D. R. Riley (General Electric Co. Atomic Power

Equipment Dept., San Jose, Calif.). Feb. 25, 1962. Contract AT(04-3)-189. 261p.

The design, performance, and cost information on the nuclear portion of the Mixed Spectrum Superheater power plant are emphasized. The research and development programs required to ensure plant feasibility are also presented. The nuclear steam supply system, reactor auxiliary systems, radiation control systems, control and instrumentation, special test instrumentation, plant operation and maintenance, steam cycle, turbine plant, general service systems, preliminary safeguards considerations, expansion of plant power output to 150 Mw(e), and MSSR critical experiment are described. (M.C.G.)

31256 (GNEC-212) A 200-Mw(e) DIRECT CYCLE BOILING WATER REACTOR WITH INTEGRAL NUCLEAR SUPERHEAT. Reference Design with Double-Annular Boiling-Superheating Fuel Elements. (General Nuclear Engineering Corp., Dunedin, Fla. and Combustion Engineering, Inc., Windsor, Conn.). Jan. 29, 1962. Contract AT(11-1)-795. 431p.

An improved version of an integral nuclear superheat reactor using a double-annular fuel element which boils water on its outside surface and superheats steam on its inside surfaces is described. The reactor delivers superheated steam to the turbine at 1000°F and 1200 psia with an estimated efficiency of 39.1%. Mechanical design, nuclear analysis, thermal and hydraulic design, plant design, plant equipment, operation and control, economics, research and development, and reactor safety are discussed. (M.C.G.)

31257 (HPR-23) REACTOR NOISE EXPERIMENTS WITH HBWR FIRST FUEL CHARGE. J. Freycenon (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). May 1962. 62p.

Some reactor noise measurements performed during the power operation of the first fuel charge, HBWR I, which consisted of natural metallic uranium elements canned in aluminum are described. The maximum power was limited to 5 Mw at a primary steam pressure of 5 atm for the Halden heavy water boiling reactor. Particular emphasis is placed on measurements performed on the primary side (fluctuations in the neutron flux, in the primary steam flow, and in the differential pressure between the reactor vessel and the steam transformer). The fundamental equations in random noise theory and a discussion of statistical errors in noise measurements are presented as a review. (N.W.R.)

31258 (HPR-25) INTERPRETATION OF THE DYNAMIC EXPERIMENTS WITH HBWR FIRST FUEL CHARGE. H. Schmidl and L. Stevens (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). Aug. 1962. 121p.

A transfer function model is developed for HBWR first fuel charge. The results of dynamic experiments are compared with this model and to another one developed previously. Good agreement between theory and experiment is obtained over the entire range of measurements, i.e., from 0.001 to 0.2 rad/s. (auth)

31259 (JPL-TR-32-278) FLUX DEPRESSION AND FISSION-FRAGMENT ESCAPE IN A GASEOUS CORE REACTOR. D. F. Spencer (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). July 31, 1962. Contract NAS 7-100. 26p.

The fraction of fission fragments escaping from a fissionable gaseous core is determined to provide information for fission-fragment heating and exhaust-contamination calculations. A principal factor is the thermal neutron flux depression in the core, which can be determined by use of a probability-of-capture approach for the thermal neutrons in the core but cannot be estimated accurately by diffusion theory. The effect of an external magnetic field on the fission-fragment escape is shown to be insignificant for magnetic fields less than 20,000 to 50,000 gauss for fuel concentrations greater than 10^{18} particles/cm^3. Fission-fragment heating of the propellant is approximately 10% of the total for fuel concentrations of interest in the plasma core reactor. Furthermore, it is very difficult to reduce the fraction of fission fragments lost below 4%; thus, the minimum amount of contamination in the exhaust is limited. (auth)

31260 (NAA-SR-7366) ENGINEERING AND CONSTRUCTING THE HALLAM NUCLEAR POWER FACILITY REACTOR STRUCTURE. J. E. Mahlmeister, W. V. Haberer, D. F. Casey, J. Susnir, T. Ricci, and W. S. Peck (Atomics International. Div. of North American Aviation Inc., Canoga Park, Calif.). Dec. 15, 1960. Contract AT(11-1)-Gen-8. 68p.

The Hallam Nuclear Power Facility reactor structure, including the cavity liner, is described, and the design philosophy and special design requirements which were developed during the preliminary and final engineering phases of the project are explained. The structure was designed for 600°F inlet and 1000°F outlet operating sodium temperatures and fabricated of austenitic and ferritic stainless steels. Support for the reactor core components and adequate containment for biological safeguards were readily provided even though quite conservative design philosophy was used. The calculated operating characteristics, including heat generation, temperature distributions and stress levels for full-power operation, are summarized. Ship fabrication and field installation experiences are also briefly related. Results of this project have established that the sodium graphite reactor permits practical and economical fabrication and field erection procedures; considerably higher operating design temperatures are believed possible without radical design changes. Also, larger reactor structures can be similarly constructed for higher capacity (300 to 1000 Mwe) nuclear power plants. (auth)

31261 (NAA-SR-7413) POPR—PROTOTYPE ORGANIC POWER REACTOR POWER DISTRIBUTIONS. H. Rood (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1962. Contract AT(11-1)-Gen-8. 32p.

In order to investigate the effects of control rod programming and fuel element management on the POPR (Prototype Organic Power Reactor) power distribution, a series of two-dimensional neutron diffusion calculations was performed. These two-group calculations were made using the PDQ digital computer code in X-Y coordinates. The power distribution in a horizontal plane through the reactor core was determined for a variety of core configurations. Typical control rod patterns were investigated for the initial core, the beginning-of-cycle equilibrium core, and the end-of-cycle equilibrium core. These calculations indicated that the use of a circumferential flux suppressor will significantly reduce the large power peaks that would otherwise occur at the radial periphery of the core. On the basis of this series of calculations, new estimates were made of the POPR power peaking factors. (auth)

31262 (NDA-2153-1) CIVILIAN POWER REACTOR PROGRAM. PART I. SUMMARY OF TECHNICAL AND ECONOMIC STATUS AS OF 1960. HEAVY WATER-

MODERATED POWER REACTORS. J. H. Hutton, S. A. Davis, C. C. Graves, and J. G. Duffy, comps. (Nuclear Development Corp. of America, White Plains, N. Y.). Aug. 19, 1960. Contract AT(30-1)-2303(XIV). 19p.

A revision of section 8 of TID-8516, Part I, is presented. The reactor concept which is presented is a change from the former design, a pressurized-pressure vessel-indirect cycle plant to a boiling-pressure tube-direct cycle plant. A description of the plant and a summary of characteristics for the 110- and 325-Mwe systems are given. (J.R.D.)

31263 (NDA-2153-2) CIVILIAN POWER REACTOR PROGRAM. PART II. ECONOMIC POTENTIAL AND DEVELOPMENT PROGRAM. HEAVY WATER-MODERATED POWER REACTOR. J. H. Hutton, S. A. Davis, C. C. Graves, and J. G. Duffy, comps. (Nuclear Development Corp. of America, White Plains, N. Y.). Aug. 19, 1960. Contract AT(30-1)-2303(XIV). 16p.

The reactor design which forms the base for the current economic status of D_2O-moderated reactors was estimated from developments in several reactor programs. However, since a heavy water-moderated reactor was not operated on natural U fuel at power reactor conditions, considerable improvement from this current status can be foreseen. A summary of improvements is presented concerning the concept which would result solely from operation of succeeding generation plants without a parallel development program, and improvements which would result from the successful completion of the development program as presented. One plant size was used in the evaluation of plant potential, with a 300 Mw_e nominal rating. The boiling D_2O-cooled, pressure tube direct cycle plant design was used. The current development program is outlined; this work includes several items leading to the long-range development of the concept. (auth)

31264 (NDA-2153-3) CIVILIAN POWER REACTOR PROGRAM. PART III. STATUS REPORT ON LARGE (100 AND 300 MW_e) HEAVY WATER-MODERATED POWER REACTORS—AS OF 1960. J. H. Hutton, S. A. Davis, C. C. Graves, and J. G. Duffy, comps. (Nuclear Development Corp. of America, White Plains, N. Y.). Aug. 19, 1960. Contract AT(30-1)-2303(XIV). 113p.

An evaluation of 300- and 100-Mw_e power plants was conducted using ground rules prescribed by the USAEC for this study. Costs corresponding to two average discharged fuel burnups are: 8.6 mills/kwh (8500 Mwd/metric ton) and 8.8 mills/kwh (7500 Mwd/metric ton) for the 300-Mw_e plant. Costs for the 100 Mw_e plant are 14.7 mills/kwh for an average discharged fuel burnup of 6010 Mwd/metric ton. Estimates of future potential indicate that the 300 Mw_e (8500 Mwd/metric ton) plant could produce power for 7.3 mills/kwh in a second generation, full scale plant of the same type. A further reduction to 6.4 mills/kwh should be possible as the result of the recommended ten-year development program. The current development program is adequate for providing the data needed to design and construct a prototype reactor. However, there is no natural U-fueled prototype and no prototype of the chosen reference design scheduled in the U.S. Current technology is sufficiently developed to initiate the design and construction of a pressure tube, boiling D_2O-cooled, natural UO_2-fueled reactor prototype plant in the immediate future. This plant would demonstrate the main features of a full scale plant and, in addition, would provide design data which could only be obtained by operation of a natural U-fueled reactor. (auth)

31265 (NP-11754(Vol.I)) ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST - 1st SEPTEMBER 1961. VOLUME I. (Netherlands'-Norwegian Reactor School. Advanced Study Inst., Kjeller, Norway). 1961. 212p.

Five sections of lecture notes are included for four of which separate abstracts were prepared. The section for which no abstract was prepared is concerned with in-core instrumentation for measurement of hydrodynamic parameters in water-cooled reactors. It was abstracted as ANL-6452 and appeared as NSA 16: 6085. (J.R.D.)

31266 (NP-11754(Vol.I)(Sect.I)) THE IMPORTANCE OF IN-CORE INSTRUMENTATION. Helge Christensen (Christian Michelsens Institutt for Videnskap og Andsfrihet, Bergen). Sect. I of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME I. 25p.

A discussion of in-core instrumentation for water-cooled power reactors is presented. It is noted that the trend toward more in-core instrumentation was brought about by the need to push reactor designs closer to safe limits to cut the price of nuclear power. The discussion concerns instruments for reactor performance primarily; however, control and safety instrumentation are also considered. Included are discussions of instrumentation for measurement of neutron flux, fuel temperature, hydrodynamic quantities, pressure, flow, coolant temperature, and steam voids. Other instrumentation for canning rupture detection is discussed along with a classification of in-core measurements. (J.R.D.)

31267 (NP-11754(Vol.I)(Sect.II)) RADIATION DAMAGE AND CORROSION ON CONSTRUCTIONAL MATERIALS FOR IN-CORE INSTRUMENTS. A. F. Andresen (Norway. Institutt for Atomenergi, Kjeller). Sect. II of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME I. 21p.

The effects of radiation on in-core components are discussed. These effects are partly associated with the materials which make up the components and partly on conditions of their surroundings. A basis for judging the radiation resistance of various reactor components is presented by giving a survey of the various defects and their formation mechanism, a summary of the effects of these defects on material properties, and the results of measurements on in-core instrument materials. (J.R.D.)

31268 (NP-11754(Vol.I)(Sect.III)) GENERAL REMARKS ON CABLES, SEALS AND PENETRATIONS FOR IN-CORE INSTRUMENTS. O. A. Sjaastad (Norway. Institutt for Atomenergi, Kjeller). Sect. III of ADVANCED SOURCE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY 21st AUGUST–1st SEPTEMBER 1961. VOLUME I. 19p.

A lecture is presented on the usefulness of cables and wires under various nuclear and non-nuclear conditions. A discussion is included concerning problems associated with supplying the in-core instruments with wires and cables

without breaking the integrity of the reactor system. It is not in the lecture scope to explain the observed damage to the fabrication materials. (J.R.D.)

31269 (NP-11754(Vol.I)(Sect.IV)) MEASUREMENT OF NEUTRON FLUX DISTRIBUTION. E. C. Nelson (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.). Sect. IV of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME I. 40p.

It is noted that there are many reasons for measuring neutron flux distribution in reactors and none of the devices or methods is versatile enough to be used for all applications. Discussions of factors affecting the choice of flux measurement method are presented along with several specific approaches. Emphasis is placed on chambers and similar devices that give a continuous reading of flux in the reactor. (J.R.D.)

31270 (NP-11754(Vol.II)) ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME II. (Netherlands'-Norwegian Reactor School. Advanced Study Inst., Kjeller, Norway). 1961. 225p.

Four sections containing lecture material are included. Separate abstracts were prepared for three sections. The section for which no abstract was prepared concerns fuel temperature measurement. It was abstracted as WAPD-T-1367 and appeared as NSA 16: 8370. (J.R.D.)

31271 (NP-11754(Vol.II)(Sect.II)) FAILED CARTRIDGE DETECTION. A. Goodings (United Kingdom Atomic Energy Authority. [Research Group. Atomic Energy Establishment], Winfrith, Dorset, England). Sect. II of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME II. 64p.

Discussions concerning general principles of failed reactor cartridge detection are presented. Examples are given which are related to both gas-cooled and water-cooled reactor types. Information is included concerning radioactive and non-radioactive detection methods, failure location, failure detection at shutdown, and data handling. (J.R.D.)

31272 (NP-11754(Vol.II)(Sect.III)) MEASUREMENT OF REACTOR TANK WATER LEVEL. O. A. Sjaastad (Norway. Institutt for Atomenergi, Kjeller). Sect. III of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME II. 32p.

The measurement of reactor tank level is considered as indispensable in water-cooled and moderated reactors. In a lecture on this subject, a review of basic level measuring methods is given along with discussions of signal transmission. Other discussions are included on developments in methods and devices. (J.R.D.)

31273 (NP-11754(Vol.II)(Sect.IV)) SOME REMARKS ON THE USE OF VARIATIONAL METHODS IN REACTOR EXPERIMENTATION. Helge Christensen (Christian Michelsens Institutt for Videnskapp og Andsfrihet, Bergen). Sect. IV of ADVANCED COURSE ON IN-CORE INSTRUMENTATION FOR WATER COOLED REACTORS, ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL AT INSTITUTT FOR ATOMENERGI, KJELLER, NORWAY, 21st AUGUST–1st SEPTEMBER 1961. VOLUME II. 47p.

It is noted that transfer functions are used to relate input and output in systems such as reactors. The basic ideas behind transfer function techniques are reviewed and the importance of transient conditions in reactor experimentation is pointed out. The theoretical foundation for the various experimental techniques is presented. Discussions of experimental procedures are included. (J.R.D.)

31274 (NYO-9787) SURVEY OF COMPONENT REQUIREMENTS AND AVAILABILITY FOR GAS-COOLED NUCLEAR REACTOR POWER PLANTS. DIRECT CLOSED CYCLES. G. Novickis and Z. Zudans (Franklin Inst. Labs. for Research and Development, Philadelphia). Nov. 1961. Contract AT(30-1)-2512. 190p. (I-A2392-2)

Expressions were derived for cycle thermal efficiency, work ratio, related useful work, and relative temperatures, and pressures at significant stations, all for a representative direct closed gas-turbine cycle. A parametric study of this cycle was performed for He and N_2 as coolants. Results of this parametric study are given in tables and charts. Four different cycles, corresponding to the maximum cycle temperatures equal to 1300, 1500, 1700, and 2000°F, were established for each of the gases. On the basis of these cycles, consistent form sheets were prepared for inquiries to manufacturers regarding their capabilities and availability of components. (auth)

31275 (ORNL-3336) THE RADIATION LEAKAGE SURVEY OF THE SHIELD OF THE NUCLEAR SHIP SAVANNAH. E. P. Blizard, T. V. Blosser, and R. M. Freestone, Jr. (Oak Ridge National Lab., Tenn.). Aug. 29, 1962. Contract W-7405-eng-26. 30p.

A detailed survey of the radiation from the N.S. Savannah shield was made. The study was accomplished with the reactor at its full power of 69 Mw during a cruise of 2821 miles. The results of the detailed shield survey show that the design dose rate of 0.5 rem/yr for passenger spaces is not exceeded in any region to which passengers have access. In the area restricted to crew access the design dose rate of 5.0 rem/yr is nowhere exceeded except in a small region on "D" deck in a room to which entry can readily be controlled. Specifications for cargo-hold dose rates, 0.5 rem/yr at 1/5 full power, are satisfactorily met. Additional data obtained include measurements of special points for comparison with dose rates predicted in design calculations, and an experiment examining the result of loss of water from the Savannah's subreactor shield tanks. Predicted dose rates were conservatively higher than the dose rates measured, and the result of the water-loss experiment showed that even with a total emptying of the tanks a safe condition exists only a few feet from the shield. (auth)

31276 (TID-16495(Rev.1)) TEN YEAR CORE DEVELOPMENT PROGRAM FOR AEC-ARMY REACTORS. J. G. Gallagher (Alco Products, Inc., Schenectady, N. Y.). Apr. 19, 1962. Contract AT(30-1)-2639. 59p. (AP-Note-355(Rev.1))

Replacement core developments for SM-1, SM-1A, PM-2A, and PL-3 are reported. Progress made in control rod absorber development and in nuclear and metallurgical technology is also reported with respect to this program. (N.W.R.)

31277 (UCRL-6031) CONTROL CONCEPTS FOR NUCLEAR RAMJET REACTORS. Robert E. Finnigan (California. Univ., Livermore. Lawrence Radiation Lab.). June 11, 1960. Contract W-7405-eng-48. 34p.

Test plans for Tory II-A, the first experimental reactor in the Pluto nuclear ramjet program, are reported. The fundamental objective of Tory II-A is to demonstrate that a high power-density, high-temperature, air-cooled reactor can be successfully designed, constructed, and operated. This application places requirements on the reactor control system which are considerably more stringent than those found in previous reactor systems, both from the standpoint of radiation environment and system performance. To fulfill the system requirements a high-performance reactor control system was designed and built; control actuation hardware was developed which can withstand the high-radiation environment of Tory II-A. This actuation system features radiation-tolerant electrohydraulic components: actuators, servo-valves, solenoid valves, feedback transducers, accumulators and associated hydraulic components. To provide high reliability against undesired shutdowns while carrying out high power level transients, the Tory II-A control philosophy includes a new concept in reactor safety: reliance on a nonlocking, fast-reset safety system during accident situations. The fast-reset system acts so as to hold the programmed power level rather than initiating an irreversible "scram" action. A reactor "scram," if tolerated, could produce thermal shocks which would seriously damage the core components. (auth)

31278 (UNC-5029) INVESTIGATION OF GAS-COOLED REACTOR SAFETY. Final Report. Lester Goldstein (United Nuclear Corp. Development Div., White Plains, N. Y.). Aug. 15, 1962. Contract AT(30-1)-2303. 158p.

A review and evaluation of the safety aspects of gas-cooled power reactors were made. A number of inherent and design features which limit and contain the effects of accidents were identified both for gas-cooled reactors as a class and for individual designs. The most severe accidents are those resulting from loss of coolant pressure or loss of coolant flow as a consequence of primary system component failures. Such accidents can result in release of fission products to the primary coolant and/or damage to the reactor core. Transients produced by inadvertent reactivity additions are generally minor, since these are limited by strong negative fuel temperature coefficients, large core heat capacities, and the long neutron lifetimes characteristic of most gas-cooled reactors. From a safety standpoint, the designs of the prototype gas-cooled reactors for central station plants appear to be conservative. Simplifications appear possible with increased engineering experience on the behavior of these reactors under faulty conditions. Of a number of topics suggested as needing further attention, intensive study of depressurization accidents is highlighted. (auth)

31279 (AEC-tr-5304) DESCRIPTION OF OPERATION AND MAINTENANCE OF CASK NO. 1, EL-3 TEST REACTOR, SACLAY, FRANCE. (Translation). (Société des Forges et Ateliers du Creusot, Paris). [1959]. 65p.

A description is given of the design, operation, and maintenance of the EL-3 charge and discharge cask. The operations are performed in an atmosphere of He. (J.R.D.)

31280 (AEC-tr-5329) SOME ASPECTS OF THE FRENCH POWER REACTORS PROGRAM. R. Boussard and C. Dambrine (France. Commissariat a l'Energie Atomique, Paris). Translated for Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va. 1962. 16p.

Information on the development and operation of French power reactors is presented. Fuel elements and their in-pile behavior and the behavior of the pressure vessels during service are described. (M.C.G.)

31281 (FTD-TT-62-994) PROBLEMS IN ATOMIC-POWER ENGINEERING. A. P. Aleksandrov. Translated from Vestnik Akad. Nauk S.S.S.R., 32: No. 5, 20-32(May 1962). 19p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 25012.

31282 TECHNICAL AND ECONOMICAL POSITION OF THE DEVELOPMENT OF NUCLEAR POWER STATIONS. K. Jaroschek (Technische Hochschule, Darmstadt, Ger.). Brennstoff-Wärme-Kraft, 14: 374-5 (Aug. 1962). (In German)

The principles of design of nuclear power stations are discussed. Ways of minimizing the cost of current generation are discussed for the two reactor types using natural and enriched uranium. The yearly cost as a function of hours of use for reactors is compared with that for coal-fired plants. The cost of current generation as a function of hours of use is compared between a 237-Mw(e) boiling-water reactor and a 278-Mw(e) coal-fired plant. (D.L.C.)

31283 OPERATING EXPERIENCE IN THE KAHL ATOMIC POWER STATION. August Weckesser (Versuchskernkraftwerks, Kahl, Ger.). Brennstoff-Wärme-Kraft, 14: 375-7(Aug. 1962). (In German)

The sequence of events from construction to operation of the Kahl power plant is described and illustrated in a table. The adaptability of the lattice condition and the transition behavior are discussed. (D.L.C.)

31284 ELECTRICAL SYSTEM OF THE N. S. SAVANNAH. E. A. Geary. Elec. Eng. (Trans. Am. Inst. Elec. Engrs.), 81: 347-53(May 1962).

The installation of main, auxiliary, and emergency plants, use of automatic devices for generator synchronizing and power-source transfer, and application of special interior communications and alarm systems effectively eliminates the probability of occurrence of complete power loss on the N. S. Savannah. (auth)

31285 PRESSURE SUPPRESSION. C. P. Ashworth, D. B. Barton (Pacific Gas and Electric Co., San Francisco), and C. H. Robbins. Nuclear Eng., 7: 313-21(Aug. 1962).

The direct-cycle, natural-circulation, boiling-water-cooled Humboldt Bay Power Reactor is placed in a dry well designed to withstand the maximum credible internal pressure. The dry well is vented to a pool of cool water by vent piping having large flow area. The water pool is located in a vapor-tight pressure-suppression chamber containing a large air volume. In the event of a primary system rupture, steam from the reactor discharges into the water pool; the steam is thus condensed rapidly and completely in the suppression pool, and relatively low dry-well and chamber pressures are thereby maintained. The design and development of this pressure suppression system is detailed. (T.F.H.)

31286 PHYSICS EXPERIENCE ON DFR. D. C. G. Smith and K. W. Brindley (United Kingdom Atomic Energy Authority, Dounreay, Caithness, Scotland). Nuclear Eng., 7: 347-51(Sept. 1962).

Physics experiments were carried out on the DFR at powers up to 11 Mw. Reactor kinetic characteristics were examined and the neutron flux penetrating the reactor shield was measured. The main physics experiments are described and the operating limits given. (D.L.C.)

31287 COOLANT CLEAN-UP IN DFR. J. Allen (United Kingdom Atomic Energy Authority, Dounreay, Caithness, Scotland). Nuclear Eng., 7: 352-5(Sept. 1962).

The main problem in the operation of Dounreay Fast Reactor is the removal of oxide from the liquid Na–K coolant. The oxide content is lowered by passing the coolant through cold and hot traps. It proved difficult to flow the coolant through the traps, and the problems involved in coolant clean-up are described. The primary coolant circuit was filled with the coolant in July 1959, and it was not till June 1962 that acceptable trap flows were obtained. (D.L.C.)

31288 EBR-2: A CLOSED CYCLE FAST BREEDER. Nuclear Eng., 7: 356-7(Sept. 1962).

A brief description is given of the 62.5-Mw(th) EBR-2. Coolant loading is scheduled to begin in Oct. 1962, and wet criticality should be reached by early 1963. (D.L.C.)

31289 DEVELOPMENT OF THE FAST CERAMIC REACTOR. Karl Cohen and Bertham Wolfe (General Electric Co., San Jose, Calif.). Nuclear Eng., 7: 358-9(Sept. 1962).

The development of long-life PuO_2–UO_2 fuel for 100,000-Mwd/t burnup in the Fast Ceramic Reactor (FCR) is described. Tables of the characteristics of the Experimental Fast Ceramic Reactor and the reference FCR are given. The effect of sodium volume on the reactivity is shown. Fuel cycle cost estimates for the reference FCR are given. (D.L.C.)

31290 SODIUM GRAPHITE REACTOR PROGRAMME. PART 1. Glen W. Wensch (Division of Reactor Development, AEC). Nuclear Eng., 7: 360-3(Sept. 1962).

A review of the sodium graphite reactor program is given which traces the development stages from the 20-Mw(th) SRE to the design and construction of the 75-Mw(e) Hallam nuclear power facility. Development data from SRE operation and development of fuels and materials are discussed in detail. (D.L.C.)

31291 PRECISION TUBE MANIPULATION FOR THE DRAGON PROJECT. Nuclear Eng., 7: 370-1(Sept. 1962).

The fabrication of the coil assembly for the Dragon purge gas pre-cooler is described. The assembly was made from austenitic stainless steel, and the tube specifications and tolerances are given. (D.L.C.)

31292 CHARACTERISTICS OF PM-1 (SUNDANCE). Nucleonics, 20: 37-42(Sept. 1962).

The PM-1 pressurized-water reactor, which went critical at Sundance, Wyoming, on Feb. 25, 1962, is described. The PM-3A in Antarctica is mentioned briefly. PM-1 data are given on the reactor design, nuclear design, and heat transfer. (D.L.C.)

31293 POWER REACTOR EXPERIENCE. Frank K. Pittman (U. S. Atomic Energy Commission, Washington, D. C.). Preprint Paper No. 1. New York, Engineers Joint Council, 1962. 11p.

Three commercial-size nuclear power stations in this country have been in operation long enough to furnish a significant body of operating experience: Shippingport, Dresden, and Yankee. All three have demonstrated a high degree of availability for incorporation into a major public utilities system in that they have shown capability for continuous operation at rated power over extended time periods; have made good response to load transients; have exceeded design expectations for power output; have proven easy to operate; and have had excellent safety records. Despite the outstanding operational histories of these stations, which make use of the light-water reactor concept, other concepts are not being neglected. Construction is either underway or now completed on sizable nuclear power stations utilizing gas-cooled, sodium-cooled thermal, heavy-water, sodium-cooled fast breeder, and organic cooled and moderated reactors. As operating experience for these accumulates we should be able to evaluate with more exactitude their adaptability to commercialize nuclear power stations. (auth)

31294 OPERATING EXPERIENCE WITH HEAVY WATER NUCLEAR POWER REACTORS. W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Preprint Paper No. 2. New York, Engineers Joint Council, 1962. 23p.

Operating experiences with the NRX and NRU reactors and the NPD reactor are described under the following headings: fuel irradiations, fuel handling and inspection, coolant flow and heat transfer, corrosion control, heavy-water leakage, reactivity control, pressure-tube replacement, auxiliary equipment repairs in high radiation fields, decontamination of loops and piping in situ, D_2O upgrading, and tritium control. (A.G.W.)

31295 OPERATING EXPERIENCE WITH THE YANKEE POWER REACTOR. W. J. Miller (Yankee Atomic Electric Co., Rowe, Mass.). Preprint Paper No. 3. New York, Engineers Joint Council, 1962. 14p.

Plant performance to date has agreed well with designers' predictions and there have been no major problems with the reactor or primary system. Specific problems encountered and tests conducted are discussed briefly. (A.G.W.)

31296 OPERATING EXPERIENCE HIGHLIGHTS AT SHIPPINGPORT ATOMIC POWER STATION. G. M. Oldham (Duquesne Light Co., Shippingport, Penna.). Preprint Paper No. 4. New York, Engineers Joint Council, 1962. 19p.

Five years of operation of the Shippingport Atomic Power Station are reviewed. The reactor has demonstrated high reliability throughout the operation, and core life has exceeded expectations. Maintenance and refueling can be accomplished successfully by trained personnel. Radiation exposure and contamination can be held within safe limits. It is concluded that the reactor provides a safe, stable heat source which can operate with relative ease in conjunction with a utility system. (A.G.W.)

31297 OPERATING EXPERIENCE WITH THE S. R. E. R. W. Dickinson (Atomics International, Canoga Park, Calif.) and A. C. Werden, Jr. Preprint Paper No. 5. New York, Engineers Joint Council, 1962. 28p.

In 8500 hours of combined operation the Sodium Reactor Experiment has demonstrated the feasibility of producing high-temperature superheated steam and the generation of electrical energy by a sodium-cooled, graphite-moderated reactor. Operating experiences reviewed include a description of the damage caused by a tetralin leak into the primary system and the resulting recovery operation. (A.G.W.)

31298 ONE YEAR'S OPERATIONAL EXPERIENCE AT KAHL STATION. August Weckesser (Versuchsatomkraftwerk Kahl G.m.b.H., Kahl am Main, Ger.). Preprint Paper No. 6. New York, Engineers Joint Council, 1962. 19p.

Some highlights of construction, operation, and maintenance experience at Germany's first nuclear power plant are described. Operational tests showed that the plant transient response to full load rejection is controllable by proper control rod adjustment. The plant is baseloaded to obtain the maximum experience in the minimum time. (auth)

31299 DRESDEN OPERATING EXPERIENCE. Harlan K. Hoyt (Commonwealth Edison Co., Chicago). Preprint Paper No. 7. New York, Engineers Joint Council, 1962. 13p.

Plant load schedules, maintenance and inspection experiences, and future plans are reviewed briefly. Refueling operations are described in more detail. (A.G.W.)

31300 OPERATING EXPERIENCE AT THE PLUTONIUM RECYCLE TEST REACTOR. D. R. Koberg and R. H. Purcell (General Electric Co., Richland, Wash.). Preprint Paper No. 8. New York, Engineers Joint Council, 1962. 29p. (HW-SA-2457)

The Plutonium Recycle Test Reactor, a primary facility in support of the Plutonium Recycle Program, first went critical in November, 1960. The reactor is a heavy-water-moderated, heavy-water-cooled, pressure-tube reactor which operates at 70 Mw(t) and utilizes several new reactor technology concepts. The reactor fuel to date has consisted of Pu-Al and UO_2, 19-rod cluster elements. The means of reactor control is a gas balance system controlling moderator level in the reactor. The safety control system has proven very effective. Heavy-water recirculating systems and ordinary-water single-pass coolant systems have required quality control to assure proper control over corrosion, scale formation, and other adverse conditions associated with coolant systems. Operating experience with helium pressurization of the primary coolant system is presented with emphasis on the advantages and disadvantages of helium as a pressurizing means. Operating experience with heavy water has required unique applications of leak detection and correction to achieve reasonable heavy-water inventory control. (auth)

31301 DIRECT CONVERSION THERMOELECTRIC REACTOR STUDIES. J. C. Danko, G. R. Kilp, and E. G. Schwartz (Westinghouse Electric Corp., Pittsburgh). Preprint Paper No. 11. New York, Engineers Joint Council, 1962. 31p.

A preliminary reactor arrangement study was made on a 500 kw(e) thermoelectric reactor. The reactor was light-water cooled and moderated utilizing thermal circulation for the primary coolant. Lead telluride was used for both the N- and P-type thermoelectric material. Four basic types of cylindrical fuel elements were studied: (1). Fe or Nb-UO_2 highly enriched fuel matrix, (2) BeO-UO_2 highly enriched fuel matrix, (3) low enrichment UO_2, and, (4) variable radial thickness of the thermoelectric material to match power density in any of the three above. Curves of efficiency and core loadings are presented for the various fuel element designs. (auth)

31302 NUCLEAR SUPERHEAT FOR BOILING WATER REACTORS. D. H. Imhoff and R. T. Pennington (General Electric Co., San Jose, Calif.). Preprint Paper No. 12. New York, Engineers Joint Council, 1962. 30p.

Economic incentives for development of nuclear superheat, three possible reactor types (separate nuclear superheaters, integral nuclear superheaters, and once-through nuclear superheaters), and current development results are discussed. The Vallecitos Experimental Superheat Reactor is described briefly. (A.G.W.)

31303 CNEN PROGRAM FOR A MERCURY BINARY CYCLE NUCLEAR POWER PLANT. Aldo Forcella (CNEN, Italy). Preprint Paper No. 14. New York, Engineers Joint Council, 1962. 18p.

A program leading to construction of a prototype plant consisting of a sodium-cooled fast reactor system in which the heat generated in the primary sodium is used to raise mercury vapor in a sodium-mercury boiler is described. This vapor is then expanded in a turbo-generator set where part of the reactor heat is converted into electricity. The exhaust mercury steam flows through a condenser-water boiler where the remaining heat energy is utilized to generate water steam, which is then fed to another turbo-generator through a conventional steam cycle. Discussions of mercury plant equipment, thermodynamics, and economic considerations are included. (A.G.W.)

31304 TRENDS IN POOLING AND UTILITY GROWTH. J. K. Dillard (Westinghouse Electric Corp., Pittsburgh). Preprint Paper No. 17. New York, Engineers Joint Council, 1962. 17p.

A study of the electric utility industry indicates a widespread trend toward power pools and interconnections between systems. This trend is expected to result in an increase in the average unit size of new units ordered. As unit size increases nuclear power plants compare more favorably economically with conventional plants. It is concluded that significant development effort should be directed toward very large nuclear plants. (A.G.W.)

31305 SOME ECONOMIC CONSIDERATIONS OF SLIGHTLY ENRICHED REACTOR FUEL. Andrew R. Jones and Walter J. Dollard (Westinghouse Electric Corp., Pittsburgh). Preprint Paper No. 18. New York, Engineers Joint Council, 1962. 14p.

Makeup of total fuel costs is compared for three types of UO_2 reactor cores: free-standing stainless steel clad, collapsed stainless steel clad, and Zircaloy clad. Factors considered are fuel fabrication costs, reprocessing, transportation charges, use charges, U depletion, and Pu production. Possible effects of future developments on fuel economics are discussed. (A.G.W.)

31306 IMPORTANCE OF CHEMICAL ANALYSIS IN POWER REACTOR OPERATION. Lyda M. Arnett, Harold M. Kelley, and F. Bruce Longtin (E. I. du Pont de Nemours & Co., Aiken, S. C.). Preprint Paper No. 24. New York, Engineers Joint Council, 1962. 10p.

Examples drawn from experience with the heavy-water-moderated production reactors at the Savannah River Plant illustrate the need for chemical analysis in reactor operation. A list of chemical analyses to be performed for control of the Heavy Water Components Test Reactor is given. It is concluded that some chemical analyses will be necessary for each power reactor. (A.G.W.)

31307 DESIGN AND PERFORMANCE OF THE DRESDEN STATION IN-CORE MONITOR SYSTEM. J. Forster (General Electric Co., San Jose, Calif.). Preprint Paper No. 25. New York, Engineers Joint Council, 1962. 16p.

The in-core monitoring system at Dresden provides 64 meter readings from 64 neutron-sensitive devices located within the reactor core and producing a current proportional to thermal neutron flux. The system is calibrated on a relative basis by adjusting the meter reading to be proportional to the γ activity of a Cu wire which has been activated in the same neutron flux as the sensing device. During critical periods of initial power operation, the system provided reactor operators with an accurate and reliable indication of relative neutron flux levels and absolute heat flux values. Over-all accuracy within $\pm 10\%$ and better can be expected from the present system. (A.G.W.)

31308 YANKEE REACTOR INSTRUMENTATION AND CONTROL SYSTEM. David A. Hansen, Jr. (Yankee Atomic Electric Co., Boston) and Donald Beatty. Preprint Paper No. 26. New York, Engineers Joint Council, 1962. 12p.

The installation and operating history of the instrumentation and control system of the Yankee plant are reviewed.

It is concluded that the system has proven extremely reliable. (A.G.W.)

31309 FERMI CONTROL SYSTEM TEST PROGRAM EMPLOYING ON-SITE ANALOG COMPUTER. Romolo B. Bertino, Donald F. Gasvoda, and Richard G. Olson (Detroit Edison Co., Detroit). Preprint Paper No. 27. New York, Engineers Joint Council, 1962. 22p.

Testing the feedwater system and the reactor control system of the Enrico Fermi Atomic Power Plant is described. An analog computer was used in tuning and evaluating the control system and in training operating personnel. Interconnection of the computer and control system is shown by diagrams. (A.G.W.)

31310 COMPUTER CONTROL OF NUCLEAR POWER PLANTS. Ernest Siddall (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Preprint Paper No. 29. New York, Engineers Joint Council, 1962. 32p.

The advantages and disadvantages of multiple analog systems, the control computer, and the human being for the control of complex plants are reviewed. The nature of the reliability problem is outlined. The problems involved in complete control of a plant by a computer are studied with the Douglas Point plant as an example and a guide. (auth)

31311 DEVELOPMENTS IN REACTORS WITH MOBILE FUEL. R. B. Briggs (Oak Ridge National Lab., Tenn.). Preprint Paper No. 30. New York, Engineers Joint Council, 1962. 33p.

Developments in aqueous homogeneous, molten-salt, and pebble-bed types of mobile-fuel thermal reactors are described. Specific programs discussed include the Los Alamos Power Reactor Experiments, the Homogeneous Reactor Experiments, and the Molten-Salt Reactor Experiment. Work on slurry- and suspension-type fuels and on liquid fluidized-bed reactors and gas-cooled pebble-bed reactors is reviewed. (A.G.W.)

31312 THE AVR-HIGH TEMPERATURE GAS COOLED REACTOR. Hans W. Schmidt (BBC/Krupp Reaktorbau GmbH., Mannheim, Ger.). Preprint Paper No. 31. New York, Engineers Joint Council, 1962. 20p.

The AVR Reactor, a 15-Mw(e) He-cooled, graphite-moderated reactor with gas temperatures of 850°C, is now under construction. The two typical features of this reactor are the spherical fuel elements and the arrangement of core and steam generator in a single vessel. The design philosophy, the specific problems, and the present status of the project are described. (A.G.W.)

31313 YANKEE PLANT ORGANIZATION TO MEET RESPONSIBILITIES FOR PERSONNEL SAFETY—INTERNAL RULES, TRAINING, AND SELF INSPECTION. John W. Bernsee (Yankee Atomic Electric Co., Rowe, Mass.). Preprint Paper No. 35. New York, Engineers Joint Council, 1962. 9p.

Plant design in relation to radiological safety is discussed briefly. Organization and training of plant personnel, internal rules, and a program for self inspection are described. (A.G.W.)

31314 PROGRESS REPORT ON THE PLUTONIUM RECYCLE PROGRAM. Herbert M. Parker and W. Kelley Woods (General Electric Co., Richland, Wash.). Preprint Paper No. 40. New York, Engineers Joint Council, 1962. 23p.

Progress since July 1960 on the following programs is summarized: primary research and development on Pu and Pu-U fuels, chemical processing techniques, and nuclear physics applicable to the Pu recycle program; new facilities, including the PRTR; and analytical studies of fuel cycle strategies and economics. (A.G.W.)

31315 IMPROVEMENTS IN OR RELATING TO SHIPS PROPELLED BY NUCLEAR ENERGY. (to Escher Wyss Aktiengesellschaft). British Patent 903,751. Aug. 22, 1962.

A ship with a nuclear propulsion plant is designed so that fuel charging or replacement may be carried out without taking the reactor out of the ship. The reactor is located in the forward part of the ship, and for the charging operation, the forward part of the ship is run into a shielded chamber and the bow removed for access to the reactor. (D.L.C.)

31316 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Alfred David Evans, Norman Lawrence Franklin, and Reginald Robert Gallie (to United Kingdom Atomic Energy Authority). British Patent 904,921. Sept. 5, 1962.

A method is described for operating a reactor in association with electric power generators in order to reduce the cost of the generation. Instead of beginning discharge of fuel elements immediately after the reactor is started for obtaining equilibrium conditions, the fuel channels are divided into zones of different neutron flux and the elements are interchanged between the zones and then discharged from the reactor when their irradiation has reached the reject level. Discharge of the second charge begins when the first discharge is complete and continues at a rate so that the last channel is discharged at the reject level. Equilibrium is established when the second discharge is complete, and the fraction of the second charge not used is less than 0.5, thus resulting in a saving over the previous method in which equilibrium is established on the completion of the first discharge. (D.L.C.)

31317 NUCLEAR REACTOR POWER PLANTS. (to Sulzer Freres, Societe Anonyme). British Patent 905,882. Sept. 12, 1962.

A nuclear power plant is designed in which two separate primary circuits are provided for removing heat from the reactor. Each primary circuit contains a different heat carrier, and the heat of the primary circuits is transferred to a single secondary circuit containing an evaporable working medium. A heat carrier of low vapor pressure may be used, so that pressurization of the primary circuits is not required. (D.L.C.)

31318 IMPROVEMENTS IN BOILING COOLANT NUCLEAR REACTOR SYSTEMS AND METHODS OF OPERATING SUCH SYSTEMS. (to Babcock and Wilcox Co.). British Patent 906,079. Sept. 19, 1962.

A boiling reactor system is designed in which vaporized primary coolant is separated into vapor and liquid fractions. The vapor fraction is passed to a point of use, while the liquid fraction is passed to a heat exchanger for heating a secondary coolant before being recirculated to the reactor. A by-pass is provided in the heat exchanger for regulating the temperature of the liquid fraction. (D.L.C.)

31319 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR POWERED STEAM GENERATING SYSTEMS. John Alan Dodd (to United Kingdom Atomic Energy Authority). British Patent 906,096. Sept. 19, 1962.

A reactor-steam generator system is designed with means for emergency removal of shutdown heat from the core when pumping power is not available for circulating the coolant. The system is provided with a steam generator at a higher level than the core for convection flow of the coolant. The steam generator is supplied with water and is arranged to feed steam to a steam drum to maintain the convection flow, and a circuit is provided for removing steam from the drum so that the steam can be moved by convection through a heat sink and back to the drum. A

valve is provided in the circuit for closing when temperature or pressure in the drum falls to prevent the (organic) coolant from solidifying. The system and means for emergency cooling are described with reference to a ship reactor cooled with a terphenyl coolant. (D.L.C.)

31320 IMPROVEMENTS IN OR RELATING TO STEAM-OPERATED POWER PLANT. Stefan George Bauer and Martin Honess Kendon (to Rolls-Royce Ltd.). British Patent 906,304. Sept. 19, 1962.

A nuclear power plant is designed in which the reactor is steam-cooled and radioactivity is removed from the steam before entering the turbine. The plant has a steam circuit in which the steam from the reactor is passed through one flow path of a heat exchanger and then part of this steam is passed through contact washing equipment before being reheated in a second flow path of the heat exchanger and being led to the turbine. (D.L.C.)

Production Reactors

31321 (HW-65761) NONDESTRUCTIVE TESTING HANFORD FUEL. D. C. Worlton (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 22, 1960. Contract [AT(45-1)-1350]. 34p.

A review of reactor fuel nondestructive testing development is presented for a process in which the inspection is related to complete product specifications. The objective of the process is to quantitatively specify fuel quality parameters, and to measure the entire fuel production against these specifications nondestructively. In such a system inspections must be performed rapidly, the data processed automatically, and pieces not meeting specifications segregated automatically. (J.R.D.)

31322 (HW-66182) PCTR MEASUREMENT OF THE EGCR LATTICE PARAMETERS WITH 2.6 w/o ENRICHED UO_2 FUEL. J. R. Worden and P. F. Nichols (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 26, 1960. Contract W-31-109-Eng-52. 18p.

The results of this experiment, in which a 21.875-in.-cell was used in a PCTR nonabsorbing atmosphere, are $k_\infty = 1.264 \pm 0.008$ and $f = 0.850 \pm 0.005$. Additional experimental data are given and a description of the measured effect of replacing the stainless steel end caps and spiders by graphite is included. Results of moderator fast flux measurements are also included. (J.R.D.)

31323 (HW-SA-2155) PEAK DEMAND DISPLAY SYSTEM. W. R. Moon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1961. Contract [AT(45-1)-1350]. 16p.

Hanford Atomic Products Operation pays for electrical power used by the three operating departments on a demand basis, a standard method for industrial plants. The monthly billing is thus based on the highest peak demand averaged over any of the half-hour periods during the month. Peak operation of the eight production reactors occurs approximately 15% of the month. It is therefore economically feasible to reduce the peak demand by 3 to 4 Mw by operating the 165-KE and -KW steam turbine generators. The economy of such an operation, of course, depends on the accuracy of the instrumentation indicating the demand. The best solution to this control problem is to monitor the demand pulses on the metering instruments at Midway and 300 Area Sub-Stations and to show the total on the 165-KW control room. A review of several possible methods of accomplishing the desired program showed the method superior to others. This method uses high speed counters, an oscillator, and associated relaying. Signals, or pulses, are obtained at Midway and the 300 Area and, through the use of relays, transmitted over telephone lines to 165-KW. The pulse rate is proportional to the rate of electrical energy used by the Hanford Plant. At 165-KW the pulses are read, through relays, by an actual counter, an electronic counter with an in-line digital readout. (auth)

31324 PHYSICS OF BREEDING IN FAST REACTORS. Masao Nozawa, Shoji Nomoto, and Hiroshi Ishikawa (Japan Atomic Energy Research Inst., Tokyo). Nippon Genshiryoku Gakkaishi, 4: 463-80(July 1962). (In Japanese)

Compared with thermal reactors, fast reactors have inherent advantages in the breeding properties, since the fast reactor is designed to minimize the moderating materials in its core so as to maintain a hard neutron spectrum. Design considerations and calculations for fast reactors at high neutron energies necessitate the use of data on nuclear cross sections over a wide range of neutron energy. Energy resources for the future are discussed. Nuclear constants required in calculations on fast reactors are reviewed, in connection with nuclear experiments and theories. Parametric studies of a number of types of fuel elements and reactor configurations are surveyed. Different types of fast reactors are described, with their advantages. Emphasis is placed upon the physical picture of breeding in a fast reactor rather than on calculational techniques. (auth)

Research Reactors

31325 (HW-63767) PCTR MEASUREMENT OF EGCR CONTROL ROD WORTH. P. F. Nichols, F. C. Engesser, T. J. Oakes, and R. E. Heineman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 20, 1960. Contract W-31-109-Eng-52. 20p.

The measurement of control rod strength in the Physical Constants Testing Reactor is described. Results of control rod strength measurements for the Experimental Gas Cooled Reactor are included. (J.R.D.)

31326 (IDO-16772) TEMPERATURE COEFFICIENTS OF THE REACTIVITY MEASUREMENT FACILITY. E. Fast (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). July 27, 1962. Contract AT(10-1)-205. 15p.

The temperature coefficient of the Reactivity Measurement Facility was found to be 49 ± 1 $\mu k/°C$ ($1\ \mu k = 10^{-6}\ \Delta k/k$) in the range 15.4 to 17.8°C. The change in the net reactivity of a standard sample was -0.48 ± 0.02, -0.66 ± 0.03, and -0.78 ± 0.02 $\mu k/°C$ in three measuring positions. These low values generally make temperature corrections insignificant. The above results are compared with previous determined values. This information developed in the RMF should be generally applicable to flux-trap-type reactors such as the Advanced Reactivity Measurement Facility (ARMF) and ARMF-II, now under construction. RMF was dismantled in April 1962. (auth)

31327 (IEA-44) OPERATIONAL EXPERIENCE AND UTILIZATION OF THE BRAZILIAN 5MWth SWIMMING POOL REACTOR. Azor C. Penteado Filho and M. D. de Souza Santos (Brazil. Instituto de Energia Atomica, São Paulo). Sept. 1961. 24p.

Some aspects related with the operation and utilization of the Brazilian 5 Mw(t) Swimming Pool Reactor are presented. A brief description of the reactor and associated irradiation and experimental facilities and operational data such as energy consumption, number of operations, radiation levels, temperature values, etc., obtained in high power operation, from 500 kw up to 5 Mw(t) are given. Some of

the difficulties encountered during the routine reactor operation are described. Special emphasis is given to the fuel element corrosion problem and to the pool surface activity levels at 5 Mw(t) power operation. A general description of the utilization of the reactor, specially in the production of isotopes, use of neutron beams, and training of personnel is included. The over-all organization of the Reactor Operation Section of the Reactor Physics Division is presented including its relationship with other divisions of the Institute of Atomic Energy. (auth)

31328 (IEA-45) HEALTH PHYSICS—PROCEDURE WITH THE IEAR-1 BRAZILIAN RESEARCH REACTOR. W. S. C. Hehl and D. M. Vizeu (Brazil. Instituto de Energia Atomica, Sao Paula). Sept. 1961. 12p.

The health physics routine developed for the IEAR-1-swimming pool reactor is described. Air sampling, surveys of external radiation, and contamination and waste disposal are discussed and data presented. (M.C.G.)

31329 (UCRL-6348) MEASUREMENT OF SAFETY ROD DROP TIMES AT THE LPTR. Wayne E. Williams and Frederick J. Shon (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 20, 1961. Contract W-7405-eng-48. 8p.

A sensor for measuring LPTR rod drop time is described which consists of a filter coil rated at 10h affixed to a split tube sized to fit around the outside of an LPTR magnet guide tube. When a measurement is desired, the device is lowered over the guide tube and seated on top of the core with the coil in a horizontal plan corresponding to the fully inserted limit of the soft-iron armature on the safety rod. The coil assembly is connected to an oscilloscope which is then triggered by any signal which can initiate a rod drop. By observing the oscilloscope, rod drop measurements can be made. (J.R.D.)

31330 (AEC-tr-5266) SOME PROBLEMS IN THE OPERATION OF THE BR-5 FAST NEUTRON REACTOR. M. S. Pinkhasik, N. N. Aristarkhov, and A. V. Karpov. Translation of "Nekotorye Voprosy Opyta Ekspluatatsii Reaktor na Bystrykh Neitronakh BR-5" (a publication of State Committee of the Council of Ministers of the U.S.S.R. on the Use of Atomic Energy, Moscow, 1961). 29p.

Fundamental data are presented on startup and operation of the BR-5 reactor. Aspects of sodium coolant and primary flow circuit preparation are discussed. Other discussions are included on gas removal from the coolant, heat transfer, natural circulation, and fuel handling. A table showing the technical specifications of the BR-5 is also included. (J.R.D.)

31331 ZEBRA—A ZERO-POWER FAST REACTOR. R. D. Smith (Atomic Energy Establishment, Winfrith, Eng.). Nuclear Eng., 7: 364-7 (Sept. 1962).

The Zero Energy Breeder Reactor Assembly (ZEBRA) is designed for basic neutron physics measurements on large dilute systems and for close geometrical mock-ups of power reactor designs. ZEBRA has an assembly of vertically stacked square fuel elements similar to that of ZEUS, and its design is described. Items discussed are the core structure, control and instrumentation, and fuel handling equipment. Its experimental program is described briefly. (D.L.C.)

31332 IMPROVEMENTS IN NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 904,608. Aug. 29, 1962.

A reactor for producing radioisotopes, particularly the short-lived ones, is designed which is suitable for use on the premises of an utilizing organization. The reactor comprises a core disposed in a tank of water and is operated at 10 kw and a fuel temperature of 40°C. The reactor is the same as that described in British Patent 904,610, but more details are given. Among the items discussed are a lifting assembly for irradiation specimens, control rods, drive means for control rods, and fuel elements. (D.L.C.)

31333 IMPROVEMENTS IN AND RELATING TO PICK-UP DEVICES. (to General Dynamics Corp.). British Patent 904,609. Aug. 29, 1962.

A pickup mechanism is designed for delivery and removal of specimen containers to and from a reactor such as that described in British Patents 904,610 and 904,608. The mechanism comprises an electric cable, a solenoid supported by the cable, a pair of arms operated by the solenoid between two positions, and spring-biasing means for normally maintaining the arms in one position. (D.L.C.)

31334 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. (to General Dynamics Corp.). British Patent 904,610. Aug. 29, 1962.

A reactor is designed for operation at a power up to 10 kw at ~40°C to produce radioisotopes. The reactor comprises a deep tank filled with water, a core disposed at the bottom of the reactor, and cooling means in the water. The water is circulated through the core by convection. Facilities for irradiating specimens and removing them while the reactor is still in operation are described in British Patents 904,608 and 904,609. (D.L.C.)

SPACE APPLICATIONS AND TECHNOLOGY

31335 (MND-P-3019-I) SNAP RADIOISOTOPE SPACE PROGRAMS. Quarterly Progress Report No. 11, April 1 through June 30, 1962. Task 7. (Martin Co. Nuclear Div., Baltimore). Contract AT(30-3)-217. 21p.

The reduction and analysis of data from two re-entry heating tests on simulated SNAP fuel cores were completed. Important points in the analysis are presented. Identification of one test specimen gives support to the following significant conclusions: the computational techniques used in re-entry analysis are highly accurate and the design theory applied to the design of SNAP flight hardware for burnup is conservative. Preparations for a third fuel core ablation test were concluded. For this test, data collection and reduction methods were improved through changes in the telemetry canister, the fuel-simulating alkali metals, changes in camera filters, and modification and calibration of test equipment. (auth)

31336 (NP-12011) SPACE ELECTRIC POWER SYSTEMS STUDY. Third Quarterly Progress Report, May 8, 1962–August 8, 1962. F. X. Dobler, C. L. Doughman, J. B. Fanger, et al. (Westinghouse Electric Corp. Aerospace Electrical Div., Lima, Ohio). Contract NAS5-1234. 97p.

Studies are being made for the generation, control, and transmission of electric power for space vehicles. The coolant temperature for the generator is between 500 and 1500°F. The ratings studied are between one and ten megawatts. Voltage levels for the system are between 5000 and 50,000 volts d-c. Information is presented on the effects of materials advances on generator designs, additional generator designs, the effect of frequency on the transformer and exciter-regulator, generator windage loss calculation method, and determination of the component parameters for conceptual design No. 1. (M.C.G.)

31337 (TID-11792) KIWI-A: THE FIRST ROCKET REACTOR EXPERIMENT. R. E. Schreiber (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-Eng-36]. 19p. (LADC-4674)

Kiwi-A was the first of three reactors tested thus far in the nuclear rocket propulsion program. It was a graphite reflected reactor using graphite fuel elements loaded with U^{235} in the form of uranium carbide. A central island filled with heavy water contained the neutronic control rods. Gaseous hydrogen from high pressure tanks served as the reactor coolant or propellant. The tests were conducted at the AEC Nevada Test Site in facilities constructed for this purpose. After a number of preliminary checkouts and low power runs, a run at planned power was completed and the reactor was dismantled for detailed examination. Two more reactors using the same external geometry, Kiwi-A Prime and Kiwi-A3, were constructed and tested during the past year. (auth)

31338 (UCRL-6091-T) PROPELLANTS FOR ELECTRICAL PROPULSION SYSTEMS. PANEL DISCUSSION OF ROCKET PROPELLANTS, AMERICAN CHEMICAL SOCIETY MEETING, BERKELEY, AUGUST 8. Robert H. Fox. (California. Univ., Livermore. Lawrence Radiation Lab.). [1960]. Contract [W-7405-eng-48]. 4p.

A discussion of rocket thrust systems is presented. Included is basic information concerning ion propulsion, plasma propulsion, and propulsion by heavy charged particles. (J.R.D.)

31339 NUCLEAR SPACE PROPULSION—A HISTORIC NECESSITY. D. G. Samaras. Nuclear Energy, 351-6 (Sept. 1962).

A discussion is presented of the general philosophy of nuclear space propulsion. Aviation may be divided into three regions (terrestrial, solar, and intragalactic) which corresponds with the sciences of neutral flow dynamics, ion flow dynamics, and varion flow dynamics. Nuclear energy is needed for both near and far space. Analogs are drawn between the development of chemical reactions for power production and that of nuclear reactions, and it is believed that eventually nuclear engines of the internal combustion type will be developed. The thermodynamic cycle and efficiency of a nuclear energy release system are discussed together with the various ways of transforming nuclear energy into propulsion. Liquid or gaseous nuclear fuels are considered. Design and operational requirements of a nuclear propulsion system are discussed, and it is seen that the problem of starting the system is a formidable one. (D.L.C.)

WASTE DISPOSAL AND PROCESSING

Refer also to abstracts 30496 and 30682.

31340 (BM-RI-6045) RADIOACTIVE WASTE DISPOSAL IN THE SHIPROCK-TYPE URANIUM MILLING FLOWSHEET. K. E. Tame, E. G. Valdez, and J. B. Rosenbaum (Bureau of Mines, Salt Lake City Metallurgy Research Center). Nov. 1961. 12p.

A study was made of possible modifications in conventional uranium ore-processing steps to confine and permit controlled disposal of radioactive wastes. A potential method of minimizing pollution from radioactive nuclides, principally radium-226, in uranium mill waste streams is to reuse the waste solutions within the mill. Such reuse of waste solution in the Kerr-McGee Shiprock-type process was investigated in the laboratory. The Shiprock mill employs a two-stage acid-leaching process for dissolution of the uranium, countercurrent decantation for liquid-solid separation and washing, and organophosphorus solvent extraction for recovery of the uranium and vanadium from solution. The simulated use of barren raffinate instead of fresh water in the mill circuit was carried through a laboratory campaign of 28 interlocked leaching, washing, and solvent extraction cycles. About 99 percent of the uranium and 91 percent of the vanadium were dissolved from the ore. Washing efficiency in the thickener circuit averaged about 99.5 percent when the pulp was washed with enough barren raffinate and makeup water to recover 2.5 tons of pregnant solution per ton of ore. The only solution discarded was that contained in the washed and thickened leach residue. A buildup of salts due to recycling of solutions did not adversely affect operation of the washing circuit. In preparation for separately recovering uranium and vanadium by solvent extraction, the pregnant solution was reduced to a redox potential of minus 240 millivolts with sulfur dioxide, and the pH was adjusted to 1.4 by the addition of ammonium hydroxide. About 99.5 percent of the uranium and less than 0.5 percent of the vanadium were extracted by organic feed consisting of 4 percent di-2-ethylhexyl phosphoric acid (EHPA) and 4 percent tributyl phosphate (TBP) in kerosine. Loaded organic feed from the extraction step was stripped with sodium carbonate solution to yield loaded strip liquor containing 50 grams of U_3O_8 per liter. The uranium-barren solution was treated in a separate circuit for vanadium recovery using organic feed composed of 8.5 percent EHPA and 4 percent TBP in kerosine. The loaded organic feed was stripped with 20-percent sulfuric acid solution, yielding strip liquor containing about 98 percent of the dissolved vanadium in a solution containing 100 grams of V_2O_5 per liter. Raffinate from the vanadium solvent extraction circuit was reused in washing the leach residue. The raffinates from the vanadium extraction circuit were routinely analyzed for radium-226 by the radon-emanation method. Radium in the raffinate ranged from 900 to 2,000 disintegrations per minute (d.p.m.) per liter. An upward trend was not evident, and no radium buildup occurred. Thus, reuse of raffinate in the Shiprock process appears feasible. Such reuse of raffinate would result in about a 75-percent decrease in the amount of contaminated solution discarded from the mill. (auth)

31341 (BNL-5010) NEUTRON BURNING OF LONG-LIVED NUCLIDES. L. B. Adler, M. Steinberg, and B. Manowitz (Brookhaven National Lab., Upton, N. Y.). [1960]. Contract [AT(30-2)-Gen-16]. 7p.

The feasibility of separating long-lived fission products such as Sr^{90} and Cs^{137} from the bulk fission products during fuel reprocessing and converting these nuclides to shorter-lived species via neutron absorption in a reactor blanket is evaluated. Present technology limits obtainable neutron fluxes to $10^{16}n/cm^2$-sec, or just sufficient for long-lived nuclide burning. However, practical considerations, such as added cost, loss of breeding capacity, and additional reprocessing costs, make this development unfavorable at present. The advent of high flux reactors and advances in nuclear technology could alter this situation. (J.R.D.)

31342 (HW-70874) RECOVERY OF CESIUM FROM PUREX TANK FARM SUPERNATANT SOLUTION BY FERROCYANIDE PRECIPITATION AND ABSORPTION ON DECALSO. H. H. Van Tuyl and L. A. Bray (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 18, 1961. Contract AT(45-1)-1350. 12p.

The loading of cesium on Decalso was found to be dependent on the sodium to cesium mole ratio. Loadings of 200 grams of cesium per liter of exchanger were obtained in the absence of sodium, while loadings were only 4.4 g/l at a ratio of 900, and 0.8 g/l at a ratio of 10,000. With Purex tank farm supernatant solution, the mole ratio of sodium to cesium is about 11,000, and the cesium concentration is 8×10^{-4} M. The capacity of Decalso (loaded from this supernate) is about 0.7 grams of cesium per liter of resin, or about 90 curies of cesium-137 per gallon of Decalso at 25°C. Over 95% of the cesium may be precipitated as a ferrocyanide from simulated Purex tank farm supernatant solution at a pH of 10.6 or below with nickel, or at a pH of 10.2 or below with zinc. Since the pH of actual tank farm supernatant solutions is generally less than 10.5, no pretreatment of the waste appears necessary. At the highest pH values, 2.5 millimoles of cation per liter are required, while one millimole is sufficient at lower pH values. A large excess of ferrocyanide, about 25 millimoles per liter, is desirable. Metathesis of the precipitate with an excess of silver carbonate, silver oxide, or silver nitrate at elevated temperatures liberates the cesium and, with the first two reagents, yields solutions with only small amounts of cations other than cesium and sodium. Decontamination factors of as high as 10,000 from sodium were demonstrated. Maximum cesium loading on Decalso from the cesium product solution is expected to be over 150 grams of cesium per liter of exchanger, or about 20,000 curies of cesium-137 per gallon of Decalso. (auth)

31343 (HW-72780) PROCESS DESIGN ENGINEERING PUREX ESSENTIAL WASTE ROUTING SYSTEM AND 241-AX TANK FARM. E. Doud, H. W. Stivers, G. H. Bauer, G. W. Morrow (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.), F. A. MacLean, and S. P. Robertson (Bovay Engineers, Richland, Wash.). Apr. 30, 1962. Contract W-31-109-eng-52. 127p.

The design of additional storage facilities for liquid wastes from the Purex Process is described. The proposed facility, consisting of eight 580,000 gallon net volume storage tanks with built-in leak detection, waste divertors, piping, instrumentation, change house, and miscellaneous appurtenances is diagramed. Process design, radiation shielding, hazards, and cost are discussed. (M.C.G.)

31344 (HW-SA-2513) RADIANT-HEAT SPRAY CALCINATION STUDIES. R. T. Allemann, R. L. Moore, U. L.

Upson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 20, 1962. Contract AT(45-1)-1350. 25p.

The design and operation of the hot-cell calciner and its associated equipment are described. The operation is on a continuous basis and is applied to the fixation of radioactive waste in a stable solid medium. The calcination method is applied to Purex Process waste. The equipment can be operated in a shielded cell either as a spray calciner or as a pot calciner in order to test waste calcination with actual, full-level wastes. Several cold runs will be made to study calcination characteristics of the radioactive waste, associated off-gas treatment problems, thermal properties of the waste calcine, and operation techniques and problems. (N.W.R.)

31345 (HW-SA-2581) RECOVERY AND PURIFICATION OF TECHNETIUM-99 FROM NEUTRALIZED PUREX WASTES. F. P. Roberts, F. M. Smith, and E. J. Wheelwright (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 9, 1962. Contract AT(45-1)-1350. 21p.

Technetium recovery from neutralized Purex waste supernate by ion exchange was studied on laboratory and pilot plant scales. The pertechnetate ion was shown to be absorbed from slightly acid, neutral, or basic solutions at concentrations as high as 7.5 M in nitrate by a variety of strong-base anion exchange resins. Several grams of Tc were recovered from plant waste supernate in three runs using a single five liter anion exchange bed. The recovered Tc was further purified by oxidation of Ru to RuO_4 and precipitation of the Ru on a cation exchange bed to give a Tc product of high purity. The Tc was subsequently precipitated as technetium sulfide. The results obtained show that Tc can be economically recovered from neutralized Purex wastes by a single stage ion exchange process with over-all yields greater than 80%. The Tc can be obtained with a chemical and radiochemical purity greater than 99%. (auth)

31346 (ORNL-2971(Vol.8)) BIBLIOGRAPHY ON NUCLEAR REACTOR FUEL REPROCESSING AND WASTE DISPOSAL. VOLUME 8. WASTE TREATMENT AND DISPOSAL. T. F. Connolly (Oak Ridge National Lab., Tenn.). Contract [W-7405-eng-26]. 82p.

Approximately 451 references on the disposal and treatment of radioactive wastes are given to books, bibliographies, symposia, journals, and contractors' topical reports published from 1955 to the present. (P.C.H.)

31347 (ORNL-TM-252) WASTE TREATMENT AND DISPOSAL PROGRESS REPORT FOR FEBRUARY AND MARCH 1962. R. E. Blanco and E. G. Struxness (Oak Ridge National Lab., Tenn.). Sept. 10, 1962. Contract [W-7405-Eng-26]. 75p.

High-Level Waste Calcination. Process flowsheets and an equipment layout were completed for the Idaho Chemical Processing Plant Pot Calcination Pilot Plant. A trap for removal of Hg compounds from the calciner off-gas was designed and fabricated, and several welded closures for sealing pots were leak-tested; the leak rate was less than 0.2 std cc of He per year. A mathematical study initiated to predict the control pattern for a pot during calcination indicated that, at a certain critical cake thickness, the wall temperature of the calciner must be programmed to ensure that all portions of the cake achieve, yet not exceed, approximately 1650°F. Decreasing the pressure from 750 to 570 mm Hg had little effect on the relative volatilities of Ru from 6 M HNO_3. Addition of 0.1 M H_3PO_3 to nitrate solutions of Ru chloride and Ru nitrosohydroxide with and without salts occurring in waste solutions decreased the Ru distillation by factors varying from 2920 for 6 M HNO_3 containing Ru nitrosohydroxide to 38.8 for simulated Darex waste containing Ru chloride. The thermal conductivities of a lead phosphate glass were 1.05 and 1.60 Btu hr^{-1} ft^{-1} $°F^{-1}$ at 300 and 1050°F, respectively. The production of this glass on a semiengineering scale was accompanied by volatilization of 12.5% of the original Ru and physical entrainment of <0.02% of the Pm as determined from counting Ru^{106} and Pm^{147} tracers. Simulated Darex waste solution was incorporated into glassy and microcrystalline phosphate and borophosphate solids with softening points of 850 to 900°C and densities of 2.73 to 3.75 g/cc, and containing 13.4 to 32.3 wt % waste oxides, representing volume reductions of 2.9 to 6.6. Low-Level Waste Treatment. The results of four demonstration runs in the Pilot Plant, with ORNL process waste water as feed, were essentially the same as previous ones: Sr^{90} d.f. 2000–12,000; Cs^{137} d.f. 77–3000. Plant effluent solutions contained <3% of current MPC_w values for all isotopes at the 2000-bed volume level (56,000 gal). A resin column isotope breakthrough run (HR-6) indicated a Sr^{90} release to plant effluent after 2916 bed volumes. The pretreatment portion of the scavenging-ion exchange process was improved by the addition of calcium carbonate to the flash mixer contents, either as 25 ppm of $Ca(OH)_2$ which precipitated $CaCO_3$, or as recirculated sludge from the clarifier. The lime-caustic-copperas treatment was shown to be temperature dependent, with minimum residual hardness at 26°C. Results of tap water treatment in a laboratory-scale sludge blanket clarifier containing an inner cone indicated that a size reduction of 10 to 20 is possible over present equipment. Engineering, Economics, and Hazards Evaluation. A preliminary conceptual design and cost estimate for a solids disposal facility in salt indicated costs of from 6×10^{-3} to 30×10^{-3} mill/kwh$_e$. Sixty to 85% of the total costs were attributable to mining, indicating that the best possible estimates of this item will be required for the more detailed final study. Heat transfer calculations of shipping containers for pot-calcined wastes of various ages showed that as many as thirty-six 6-in.-dia pots of calcined acidic Purex waste can be shipped in a single finned carrier after 2.4 years decay without mechanical cooling enroute. Four 24-in.-dia pots of acidic Purex waste can be shipped, per carrier, after 11 years decay. Disposal in Deep Wells. Slurries were made with simulated ORNL intermediate-activity wastes and Portland cement which met the pumping time requirements. The salts in the waste solution did not cause unexpected reactions that are undesirable for pumping operations and did not prohibitively alter the setting properties of Portland cement slurries. Disposal in Natural Salt Formations. Four plastic-flow measurement stations were installed in the Carey Salt Company mine at Hutchinson, Kansas. Each station consists of from seven to nine gages installed in such a way as to measure both floor and ceiling movement and movement of the columns. The stations are installed in areas of varying age, from recent to early in development of the mine. Two additional gages remain to be installed. An array of 20 holes for the study of effect of high temperatures on rock salt in situ was successfully drilled without use of a liquid drilling medium. Samples of dry shale from the holes contained 10 to 12% water. Clinch River Study. During periods free from storm runoff in the summer months, power waves in the Clinch River study reach are classified as uniformly progressive flow. For this type of flow the storage of water in the study reach is conditioned equally by the inflow

and outflow rates. By expressing the storage as a weighted function of these rates, the variations in flow due to power releases in the Clinch River above Centers Ferry, near Kingston, Tenn., may be determined from flow records obtained at the upstream gaging station on the Clinch River near Scarboro, Tenn. Stable chemical analyses of water samples taken during base flow measurements in September 1961 show a marked difference in the quality of water between streams draining coal-bearing clastic rocks of the Cumberland escarpment and streams draining predominantly carbonate rocks of the ridge and valley province in which Oak Ridge National Lab. is located. Streams draining the Cumberland escarpment contain a greater proportion of sulfate, Na, and chloride and have higher pH's than do streams draining the ridge and valley province. Fundamental Studies of Minerals. The Cs exchange properties of vermiculite were improved by collapsing the vermiculite lattice with ammonium ions or with one of the heavy alkali metal cations. Pretreatment of the vermiculite with K increased the number of exchange sites at the edges of collapsed basal spacings, where Cs can be incorporated into the lattice by "edge fixation." This increased the Cs K_d in 0.5 M $NaNO_3$ by a factor of 2.7. Addition of NH_4^+, Cs^+, Rb^+, or K^+ to the influent resulted in "interlayer fixation" of Cs as a result of collapse of the lattice to physically entrap the Cs sorbed at the basal surface exchange sites. In this case the Cs K_d was increased by a factor of about 4.4. White Oak Creek Basin Study. For the period May to October 1961, the Process Waste Water Treatment Plant accounted for about 92% of the Sr^{89} and Sr^{90}, 91% of the rare earths (exclusive of Y^{90}), 72% of the Cs^{137}, 76% of the Co^{60}, and 84% of the Ru^{106} discharged to White Oak Creek in Bethel Valley. Of the smaller contributors, the amount of activity detected in the sanitary sewage effluent was the most significant. The mean concentration of Sr^{90} in the effluent for the sampling period was 1.7×10^{-8} μc/cc or about 40% of MPC for continuous occupational exposure, 40-hr week. Analyses of samples taken at temporary monitoring stations along White Oak Creek and its tributaries indicate a relation between the suspended solid load in the stream and Cs transport. (auth)

31348 (TID-6767) RADIOACTIVE LIQUID WASTE MANAGEMENT AT THE KNOLLS ATOMIC POWER LABORATORY. L. J. Cherubin, M. R. Kennedy, and D. A. Manieri (Knolls Atomic Power Lab., Schenectady, N. Y.). [Sept. 1960]. Contract [W-31-109-Eng-52]. 20p.

The general relationships of the General Electric Company and the United States Atomic Energy Commission are discussed in regard to health and safety aspects of radioactivity considerations; current organizational responsibility in the Laboratory for the control of environmental health conditions; the general policy in regard to radioactive waste disposal to the environment and the sources of liquid wastes which are generated at the Laboratory. Specifically, administrative, technical and operational aspects of the Laboratory liquid radioactive waste management are discussed. Administrative aspects include relations with governmental agencies — federal and state. Technical aspects include discussion of the U. S. Geological and U. S. Public Health Service activities related to Laboratory operations as well as KAPL activities. Operational aspects include consideration of liquid wastes relative to: origin, nature, volume, activity levels, treatment and amounts released to environment and environmental monitoring programs, techniques and findings. Economics of liquid waste management are discussed as to capital investment and operational costs. (auth)

31349 TREATMENT OF LOW-LEVEL AQUEOUS RADIOACTIVE WASTES. A. T. Cartwright (Nuclear Chemical Plant Ltd., London). Nuclear Energy, 272-8(July 1962).

A review is given on various methods for the treatment of low-level aqueous radioactive wastes, and the waste disposal system at Latina, Italy, is described. The plant is designed to treat fuel element cooling pond water together with other low-active streams arising on the site, producing clean water that can be used again on the site, decontaminated water that can be safely discharged to the environment, and drums of sludge and concentrate which will be stored indefinitely under safe conditions. An effluent plant is included to ensure that no hazard will be caused to the surrounding population or to the local amenities by discharge of wastes in liquid form during the life of the power station. A design of the plant is given. (P.C.H.)

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GEORGIA INST. OF TECH., ATLANTA.
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GERMANY. BUNDESMINISTERIUM FÜR ATOMKERNENERGIE, BAD GODESBERG.
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GMELIN-INSTITUT FÜR ANORGANISCHE CHEMIE UND GRENZGEBIETE, FRANKFURT AM MAIN.
Bibliography on x radiation effects on living tissue, 16: 30206 (AED-BRD-C-04-3)

GOODYEAR ATOMIC CORP., PORTSMOUTH, OHIO.
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Electrolytic reduction of U(VI), 16: 30355 (AEET/CD/7)
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Deposition of radioactivity in world, 16: 30202 (NP-12006)

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JOHNSTON (WILLIAM H.) LABS., INC., BALTIMORE.
Prog. rpt. on dilution on-stream isotopic tracers, 16: 30698 (JLJ-650-9-1)

JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Root-mean-square radius of transition He^3–H^3, 16: 31009 (JINR-E-1012)

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KANSAS. UNIV., LAWRENCE.
Inhibition of radiation polymerization in monomer, 16: 30448 (TID-15961)
System U–O–S, 16: 30370 (TID-12048)

KENTUCKY. UNIV., LEXINGTON.
Multiple meson production in π^--p collisions, 16: 31005 (BNL-6213)

KERNFORSCHUNGSANLAGE, JÜLICH, GERMANY.
Bibliography on legal and economic questions on atomic energy, 16: 30163 (NP-12002)

KERNFORSCHUNGSZENTRUM, KARLSRUHE, GERMANY.
Electron scattering on nucleons, 16: 31010 (KFK-83)

KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
BMS—stress analysis of cylindrical shells, 16: 30514 (KAPL-M-EC-20)
CURFIT-2—curve fitting program, 16: 30711 (KAPL-M-EC-25)
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LITTLE (ARTHUR D.) INC., CAMBRIDGE, MASS.
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LOCKHEED NUCLEAR PRODUCTS, MARIETTA, GA.
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LONG BEACH STATE COLL., LONG BEACH, CALIF.

Stark broadening of H and hydrogenic neutral and ionized He lines, 16: 31139 (NRL-5805)
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Electrical resistivity of partially ionized Cs plasma, 16: 31137 (LADC-5226)
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MARTIN-MARIETTA CORP. AEROSPACE DIV., BALTIMORE.
Prog. rpt. on SNAP programs, 16: 31335 (MND-P-3019-1)
MARYLAND. UNIV., COLLEGE PARK.
Motion of non-conducting sphere through conducting fluid, 16: 30706 (AROD-407:59)
Stark broadening of H and hydrogenic neutral and ionized He lines, 16: 31139 (NRL-5805)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Helical flow of electrolyte with magnetic field, 16: 30551 (MIT-AL-TR-23)
Prog. rpt. on electronics, 16: 30172 (TID-16489)
Prog. rpt. on mineral engineering, 16: 30790 (MITS-48)
Prog. rpt. on nuclear research, 16: 30930 (NYO-2669)
Prog. rpt. on organic reactor coolants, 16: 31217 (MITNE-12)
MATERIALS RESEARCH CORP., YONKERS, N. Y.
Grain-boundary sliding in non-metallic bi-crystals, 16: 30791 (MRC-182)
MEHARRY MEDICAL COLL., NASHVILLE.
Prog. rpt. on effects of radiation on cells, 16: 30213 (ORO-566)
METCUT RESEARCH ASSOCIATES INC., CINCINNATI.
Prog. rpt. on machining refractory materials, 16: 30742 (ASD-TR-7-532a(VII))
MINNESOTA. UNIV., MINNEAPOLIS.
Prog. rpt. on heat transfer, 16: 30553 (TID-16496)

N

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD INST. FOR SPACE STUDIES, NEW YORK.
Early chronology of solar system, 16: 30989 (NASA-TN-D-1465)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Monte Carlo calculations of neutron number spectra, 16: 31218 (NASA-TN-D-1434)
NATIONAL CARBON CO., PARMA, OHIO.
Advanced graphite materials, 16: 30810 (WADD-TR-61-72(Vol.VI))
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Chemistry of radioactive components of U mill wastes, 16: 30450 (TID-16511)
NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Gamma penetration into aircraft carrier, 16: 31178 (USNRDL-TR-343)
Gamma penetration into aircraft carrier, 16: 31180 (USNRDL-TR-412)
Radiation-induced homologous chimeras, 16: 30220 (USNRDL-TR-575)
Radiological trainer device X11F3, 16: 30683 (USNRDL-ER-12)
Ship shielding studies, 16: 31179 (USNRDL-TR-373)
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Dosimetry by solid state devices, 16: 30586 (NRL-5777)
Prog. rpt. on properties of Na and K, 16: 30365 (NRL-5844)
Stark broadening of H and hydrogenic neutral and ionized He lines, 16: 31139 (NRL-5805)
NETHERLANDS'–NORWEGIAN REACTOR SCHOOL. ADVANCED STUDY INST., KJELLER, NORWAY.
In-core instrumentation for water cooled reactors, 16: 31265 (NP-11754 (Vol.I))
In-core instrumentation for water cooled reactors, 16: 31270 (NP-11754 (Vol.II))
NEW ENGLAND DEACONESS HOSPITAL, BOSTON.
Pituitary changes in parabiosed and irradiated rats, 16: 30214 (TID-6875)
NEW JERSEY. STATE DEPT. OF HEALTH. RADIUM RESEARCH PROJECT, WEST ORANGE.
Follow-up of Ra dial painters, 16: 30211 (NYO-2759)
NEW YORK UNIV., NEW YORK.
Paramagnetic resonance in solid state, 16: 30928 (NP-11996)
NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.
Cables, seals and penetrations for in-core instruments, 16: 31268 (NP-11754(Vol.I)(Sect.III))
Damage to materials for in-core instruments, 16: 31267 (NP-11754 (Vol.I)(Sect.II))
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NORWAY. INSTITUTT FOR ATOMENERGI. OECD HALDEN REAKTOR PROSJEKT.
Experiments with HBWR first fuel charge, 16: 31258 (HPR-25)
Noise experiments with HBWR fuel charge, 16: 31257 (HPR-23)
NUCLEAR DEVELOPMENT CORP. OF AMERICA, WHITE PLAINS, N. Y.
Civilian power reactor program. I., 16: 31262 (NDA-2153-1)
Civilian power reactor program. II., 16: 31263 (NDA-2153-2)
Civilian power reactor program. III., 16: 31264 (NDA-2153-3)
NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PENNA.
Prog. rpt. on Pu fuels, 16: 30796 (NUMEC-P-101)
Uranium feed enrichment for recycle operation, 16: 30483 (NUMEC-P-23)
NUCLEAR METALS, INC., CONCORD, MASS.
Impurity effects in Be, 16: 30792 (NMI-TJ-40(Rev.))
Prog. rpt. on Be corrosion, 16: 30737 (NMI-1903)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Centrifuge efficiencies, 16: 30701 (K-1537)
Vapor pressure of UF_6, 16: 30482 (K-1448)
OAK RIDGE INST. OF NUCLEAR STUDIES, INC., TENN.
Prog. rpt. of Medical Division, 1961, 16: 30212 (ORINS-41)
OAK RIDGE NATIONAL LAB., TENN.
Analysis of UO_2 dissolution in HNO_3, 16: 30366 (ORNL-3297)
Applied research, 16: 30169 (ORNL-3313(p.133-78))
Bibliography on reactor fuel reprocessing and waste disposal, 16: 31346 (ORNL-2971(Vol.8))
Bibliography on reactor fuel reprocessing and waste disposal, 16: 30496 (ORNL-2971(Vol.5))
Coulometric titration of Pu, 16: 30329 (ORNL-TM-366)
Creep properties of stainless steel at elevated temperatures, 16: 30797 (ORNL-2972)
Energy removed from proton and neutron beams by tissue, 16: 30931 (ORNL-3260)
Fundamental research, 16: 30170 (ORNL-3313(p.179-208))
Leakage survey of shield of NS *Savannah*, 16: 31275 (ORNL-3336)
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Size effects and interstitial impurities in Nb_3Zr superconductors, 16: 30798 (ORNL-3303)

OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
Radiolysis of dibromodichloromethane, 16: 30451 (TID-16579)

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Equilibrium phase transition pressures, 16: 30794 (NP-11998)

PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Nuclear startup of Spert II reactor, 16: 31212 (IDO-16762)
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Ratios of asymmetric-to-symmetric fission of U-233, Pu-239 and U-235, 16: 31063 (IDO-16797)
Temperature coefficients of RMF, 16: 31326 (IDO-16772)

PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP., HARTFORD, CONN.
Prog. rpt. on emissivity of materials, 16: 30800 (PWA-1877)
Prog. rpt. on emissivity of materials, 16: 30802 (PWA-1966)
Prog. rpt. on emissivity of materials, 16: 30801 (PWA-1878)

PRINCETON UNIV., N. J.
Double stripping and pickup reactions, 16: 31068 (PUC-1962-77)

PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
Radiological Health Data, Vol. 3, No. 6, 16: 30693
Radiological Health Data, Vol. 3, No. 8, 16: 30694

R

RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Plasma models describing propagation in magneto-ionic media, 16: 31138 (NP-11995)

ROCHESTER, N. Y. UNIV.
Application of projection theorem to nuclei, 16: 31067 (NYO-9536)
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SLOAN-KETTERING INST. FOR CANCER RESEARCH, NEW YORK.
Prog. rpt. on measurement of local absorbed dose, 16: 30589 (TID-16524)

SOCIÉTÉ BELGE POUR L'INDUSTRIE NUCLÉAIRE, BRUSSELS.
Compaction of UO_2, 16: 30747 (EURAEC-280)
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ä	**becomes**	**ae**
ö		**oe**
ø		**oe**
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The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. The report numbers for the non-AEC reports in these series are marked with an asterisk (*). Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(2nd Rev.), *Report Number Series Used by the Technical Information Service in Cataloging Reports*. March 1960, $2.75 (OTS), and supplement, August 1960, $0.50 (OTS).

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JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C.
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Report No.	Abstract No.	Availability
AD–	**(Misc.)**	
270740*	16-30683	See USNRDL-ER-12
283548*	16-30332	See WAL-TR-823/5
283833*	16-30720	See NP-12047
284073*	16-31011	See NP-12028
AEC-tr–		
4513	16-30725	Dep.; $5.50(OTS)
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1565	16-30705	Dep.; $0.50(AECL)
1566	16-30898	See CRGM-1093
1577	16-31050	Dep.; $0.50(AECL)
1578	16-31051	Dep.; $0.50(AECL)
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C-04-3	16-30206	Dep.(mc)
AEET-CD–	**(Indian)**	
6	16-30354	Dep.(mc)
7	16-30355	Dep.(mc)
AFOSR–	**(Misc.)**	
2806*	16-30551	See MIT-AL-TR-23
AGN-AN–	**(Non-AEC)**	
584	16-30443	See ASD-TR-7-840A(V)
676	16-30311	
ANL–		
6274	16-30740	Dep.; $0.75(OTS)
6474	16-30178	Dep.; $2.25(OTS)
6516	16-30717	Dep.; $5.00(OTS)
6529	16-30777	Dep.; $0.75(OTS)
6548	16-30718	Dep.; $2.00(OTS)
6555	16-31196	Dep.; $1.50(OTS)
6579	16-30569	Dep.; $1.25(OTS)
6585	16-30894	Dep.; $0.50(OTS)
6597	16-31197	Dep.; $1.50(OTS)
ANL-FGF–		
218	16-31198	Dep.(mc); $2.60(fs), $0.98(mf) OTS
298	16-30739	J. Nuclear Materials, 6: 157-71(1962)
AP-Note–	**(Misc.)**	
355(Rev. 1)	16-31276	See TID-16495(Rev. I)
APAE-Memo–	**(Misc.)**	
312	16-31250	Dep.(mc); $5.60(fs), $1.97(mf) OTS
ARF–	**(Misc.)**	
2181-12	16-30733	Dep.; $2.00(OTS)
AROD–	**(Misc.)**	
407:59*	16-30706	
442:9*	16-31003	
ASD-TDR–	**(Non-AEC)**	
62-292	16-30741	OTS
ASD-TR–	**(Non-AEC)**	
7-532a(VII)	16-30742	
7-840A(V)	16-30443	
7-840A(VI)	16-30311	See AGN-AN-676
ATL-A–		
130	16-30719	Dep.(mc); $1.10(fs), $0.80(mf) OTS
AWRE-O–	**(British)**	
48/62	16-30778	Dep.(mc)
AWRE-Trans.–	**(British)**	
37	16-30499	Dep.(mc)
BM-RI–	**(Misc.)**	
6033	16-30356	Free (Bureau of Mines)
6045	16-31340	Free (Bureau of Mines)
BMI–	**(Misc.)**	
1277	16-30779	Dep.(mc); $2.60(fs), $1.01(mf) OTS
BMI-X–		
170(Del.)	16-30780	Dep.(mc); $3.60(fs), $1.34(mf) OTS
BN–	**(Non-AEC)**	
6111-05	16-30747	See EURAEC-280
6112-03	16-30748	See EURAEC-281
6203-11	16-30783	See EURAEC-283
BNL–		
741	16-31126	Dep.; $0.50(OTS)
4795	16-30570	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4905	16-30207	Dep.(mc); $8.10(fs), $2.87(mf) OTS
4920	16-30444	Dep.(mc); $3.60(fs), $1.25(mf) OTS
4950	16-30571	Dep.(mc); $1.10(fs), $0.80(mf) OTS
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6138	16-31099	Phys. Rev. 128: 242-6(1962)
6147	16-30470	Radiation Research 17: 302-11(1962)
6213	16-31005	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6231	16-30357	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6263	16-30781	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6333	16-30897	Dep.(mc); $1.60(fs), $0.80(mf) OTS
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A-1154	16-31075	Dep.(mc); $1.60(fs), $0.80(mf) JCL
R-1573	16-30560	Dep.(mc); $2.60(fs), $0.95(mf) JCL or OTS
R-1576	16-30376	Dep.(mc); $1.10(fs), $0.80(mf) JCL
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122	16-30782	Dep.(mc); $5.60(fs), $1.82(mf) OTS
124	16-31251	$4.60(fs), $1.61(mf) OTS
125	16-31252	Dep.(mc); $2.60(fs), $1.07(mf) OTS
126	16-31199	Dep.(mc); $2.60(fs), $0.92(mf) OTS
160	16-31200	Dep.(mc); $1.60(fs), $0.80(mf) OTS
CERN–	**(European Organization for Nuclear Research)**	
62-18	16-31007	Dep.(mc)
62-21	16-31008	Dep.(mc)
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1093	16-30898	Dep.; $1.50(AECL)
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D–	**(Misc.)**	
2-90044*	16-30899	
DP–		
586	16-30745	Dep.(mc); $3.60(fs), $1.34(mf) OTS
681	16-30746	Dep.(mc); $1.60(fs), $0.80(mf) OTS
751	16-30323	Dep.; $0.50(OTS)
760	16-30572	Dep.; $0.50(OTS)
764	16-30511	Dep.; $0.50(OTS)
765	16-31253	Dep.; $0.75(OTS)
769	16-30512	Dep.; $0.50(OTS)
DPR-INF–	**(British)**	
268	16-30697	Dep.(mc); Free(BIS)
269	16-30671	Dep.(mc); Free(BIS)
DRCL–	**(Canadian)**	
371	16-30161	Dep.(mc)
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
ER–	**(Misc.)**	
5848*	16-30909	See NP-12004
EU-B–	**(German)**	
13	16-30813	For translation see EURAEC-359
14	16-30814	For translation see EURAEC-360

Report No.	Abstract No.	Availability
15	16-30815	For translation see EURAEC-361
16	16-30816	For translation see EURAEC-362
EURAEC–		
178	16-30358	Dep.(mc); $1.60(fs), $0.80(mf) OTS
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281	16-30748	Dep.(mc); $4.60(fs), $1.52(mf) OTS
283	16-30783	Dep.(mc); $4.60(fs), $1.61(mf) OTS
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326	16-30900	Dep.(mc); $1.60(fs), $0.80(mf) OTS
336	16-30719	See ATL-A-130
359	16-30813	Dep.(mc); $1.60(fs), $0.80(mf) OTS
360	16-30814	Dep.(mc); $4.60(fs), $1.61(mf) OTS
361	16-30815	Dep.(mc); $1.60(fs), $0.80(mf) OTS
362	16-30816	Dep.(mc); $1.60(fs), $0.80(mf) OTS
FN-E–	**(Italian)**	
23	16-30756	For translation see EURAEC-321
FTD-TT–	**(Non-AEC)**	
62-86	16-31145	OTS
62-501	16-30222	OTS
62-924	16-31026	OTS
62-994	16-31281	OTS
FZK–	**(Non-AEC)**	
9-176	16-31177	See NARF-62-6T
GA–	**(Misc.)**	
3176	16-31052	Dep.(mc); $5.60(fs), $1.73(mf) OTS
3371	16-31053	Dep.(mc); $2.60(fs), $0.95(mf) OTS
3376	16-30784	Dep.(mc); $2.60(fs), $0.86(mf) OTS
GACD–	**(Non-AEC)**	
3178	16-30901	
GAMD–	**(Misc.)**	
1961	16-30573	Dep.(mc); $1.10(fs), $0.80(mf) OTS
2877(Rev.)	16-31202	Dep.(mc); $3.60(fs), $1.13(mf) OTS
GAT-T–		
828	16-30324	Dep.(mc); $1.10(fs), $0.80(mf) OTS
GEAP–	**(Misc.)**	
3779	16-30734	Dep.; $1.00(OTS)
3784	16-31254	Dep.; $1.50(OTS)
3882	16-31203	Dep.; $2.25(OTS)
3943	16-31204	$3.60(fs), $1.13(mf) OTS
3946	16-31205	Dep.(mc); $6.60(fs), $2.27(mf) OTS
4016	16-31255	Dep.; $3.50(OTS)
4024	16-31206	Dep.; $3.00(OTS)
GHEC–		
212	16-31256	Dep.; $5.50(OTS)
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23	16-31257	Dep.(mc)
25	16-31258	Dep.(mc)
HW–		
57332	16-31207	Dep.(mc); $1.60(fs), $0.80(mf) OTS
61923	16-30902	Dep.(mc); $2.60(fs), $0.92(mf) OTS
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1946	16-31208	Dep.(mc); $2.60(fs), $1.04(mf) OTS
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2178	16-30580	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2295	16-30695	Preprint Paper No. 16. New York, Engineers Joint Council, 1962.
2333	16-30736	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2373	16-30505	Preprint Paper No. 15. New York, Engineers Joint Council, 1962.
2500	16-30904	Dep.(mc); $3.60(fs), $1.13(mf) OTS
2508	16-31210	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2513	16-31344	Dep.(mc); $2.60(fs), $0.95(mf) OTS
2538	16-30905	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2541	16-31054	Dep.(mc); $2.60(fs), $1.01(mf) OTS
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2644	16-31211	Dep.(mc); $2.60(fs), $0.86(mf) OTS
2654	16-30906	Dep.(mc); $3.60(fs), $1.19(mf) OTS
2660	16-30208	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2673	16-30907	Dep.(mc); $2.60(fs), $0.95(mf) OTS
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2688	16-30197	Dep.(mc); $2.60(fs), $0.92(mf) OTS
HW-tr–		
42	16-30378	Dep.(mc); $1.60(fs), $0.80(mf) JCL
I–	**(Misc.)**	
A2392-2	16-31274	See NYO-9787
IA–	**(Non-AEC)**	
700	16-30657	Dep.(mc)
713	16-30582	Dep.(mc)
726	16-30162	Dep.(mc)
IDO–		
11103	16-31217	See MITNE-12
14588	16-30327	Dep.; $2.75(OTS)
14589	16-30495	Dep.; $1.00(OTS)
16762	16-31212	Dep.; $1.00(OTS)
16772	16-31326	Dep.; $0.50(OTS)
16787	16-31213	Dep.; $2.50(OTS)
16788	16-31214	Dep.; $0.50(OTS)
16797	16-31063	Dep.; $0.50(OTS)
19025	16-31251	See CEND-124
19026	16-31252	See CEND-125
19027	16-31199	See CEND-126
IEA–	**(Non-AEC)**	
44	16-31327	Dep.(mc)
45	16-31328	Dep.(mc)
IS–		
181	16-30361	Dep.(mc); $2.60(fs), $0.92(mf) OTS
232	16-30362	Dep.(mc); $4.60(fs), $1.64(mf) OTS
238	16-31065	Dep.(mc); $1.60(fs), $0.80(mf) OTS
247	16-30786	Dep.(mc); $1.60(fs), $0.80(mf) OTS
252	16-31064	Dep.(mc); $1.60(fs), $0.80(mf) OTS
257	16-30787	Dep.(mc); $2.60(fs), $0.92(mf) OTS
268	16-30788	Dep.(mc); $1.60(fs), $0.80(mf) OTS

Report No.	Abstract No.	Availability
287	16-30363	Dep.(mc); $1.10(fs), $0.80(mf) OTS
387	16-30400	Spectrochim. Acta, 18: 1127-53(1962)
JAERI–	**(Japanese)**	
1034	16-30999	
JEH–	**(Spanish)**	
98-DQ/I-29	16-30328	Dep.(mc)
JINR–	**(Russian)**	
E-1012	16-31009	Dep.(mc)
JLI–		
650-9-1	16-30698	Dep.; $3.00(OTS)
JPL-TR–	**(Non-AEC)**	
32-278	16-31259	
JPRS–	**(Non-AEC)**	
13623	16-30379	OTS
14974	16-30684	OTS
15086	16-30173	OTS
15154	16-30286	OTS
15220	16-30226	OTS
K–		
1448	16-30482	Dep.(mc); $2.60(fs), $0.83(mf) OTS
1537	16-30701	Dep.; $0.75(OTS)
KAPL-M–		
EC-20	16-30514	Dep.(mc); $5.60(fs), $1.82(mf) OTS
EC-23	16-30710	Dep.(mc); $2.60(fs), $1.01(mf) OTS
EC-25	16-30711	Dep.(mc); $7.60(fs), $2.42(mf) OTS
JA-6(Rev.IV)	16-30712	Dep.(mc); $10.50(fs), $4.13(mf) OTS
SR-1	16-31215	Dep.(mc); $3.60(fs), $1.25(mf) OTS
KFK–	**(German)**	
83	16-31010	Dep.(mc)
LA–		
2724	16-30583	Dep.; $1.50(OTS)
2727	16-30584	Dep.(mc); $0.50(OTS)
LADC–		
3678	16-31000	See TID-6759
4055	16-31216	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4259	16-30803	See TID-11432
4381	16-30369	See TID-11153
4508	16-30679	See TID-11461
4607	16-31012	See TID-11120
4674	16-31337	See TID-11792
4676	16-31223	See TID-12751
5176	16-30364	Dep.(mc); $3.60(fs), $1.19(mf) OTS
5226	16-31137	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5227	16-30925	Dep.(mc); $2.60(fs), $0.83(mf) OTS
5230	16-30926	Dep.(mc); $2.60(fs), $0.86(mf) OTS
5281	16-30750	Dep.(mc); $5.60(fs), $1.91(mf) OTS
5288	16-30550	Dep.(mc); $3.60(fs), $1.37(mf) OTS
5311	16-30927	Dep.(mc); $2.60(fs), $0.95(mf) OTS
5345	16-30313	Can. J. Chem., 40: 1742-5(1962)
5370	16-30675	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5381	16-31056	$5.60(fs), $1.97(mf) OTS
LAMS–		
2725	16-30789	Dep.; $2.00(OTS)
2734	16-30585	Dep.; $0.50(OTS)
LE–		
392-1	16-30593	See UCRL-6012-T
M–	**(Misc.)**	
62-26-1*	16-30720	See NP-12047
MIT-AL–	**(Non-AEC)**	
TR-23	16-30551	
MITNE–		
12	16-31217	Dep.(mc); $2.60(fs), $0.95(mf) OTS
MITS–		
48	16-30790	Dep.; $1.25(OTS)
ML–	**(Misc.)**	
865	16-31140	See TID-14434
MND-P–		
3019-1	16-31335	Dep.; $0.50(OTS)
MR-N–	**(Non-AEC)**	
296	16-30908	See NARF-62-10T
MRC–	**(Misc.)**	
182	16-30791	Dep.(mc); $3.60(fs), $1.40(mf) OTS
NAA-SR–		
7325	16-30552	Dep.; $1.25(OTS)
7366	16-31260	Dep.; $1.50(OTS)
7413	16-31261	Dep.; $0.50(OTS)
NARF–	**(Non-AEC)**	
62-6T	16-31177	
62-10T	16-30908	
NASA-TN–	**(Misc.)**	
D-1434*	16-31218	$0.50(OTS)
D-1465*	16-30989	$0.50(OTS)
NDA–	**(Misc.)**	
2153-1	16-31262	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2153-2	16-31263	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2153-3	16-31264	Dep.(mc); $9.60(fs), $3.59(mf) OTS
NMI–	**(Misc.)**	
1903	16-30737	Dep.(mc); $2.60(fs), $1.07(mf) OTS
NMI-TJ–		
40(Rev.)	16-30792	Dep.(mc); $2.60(fs), $0.95(mf) OTS
NP–	**(AEC File No. for Non-AEC Reports)**	
11746	16-31066	Dep.(mc)
11754(Vol.I)	16-31265	Dep.(mc)
11754(Vol.II)	16-31270	Dep.(mc)
11993	16-30793	
11995	16-31138	
11996	16-30928	
11998	16-30794	
12000	16-30658	
12002	16-30163	Dep.(mc)
12003	16-30929	
12004	16-30909	
12006	16-30202	Dep.(mc)
12008	16-30164	Dep.(mc)
12011	16-31336	
12016	16-30676	
12019	16-30677	Dep.(mc)
12021	16-30210	Dep.(mc)
12028	16-31011	$4.60(OTS)
12031	16-30659	
12047	16-30720	$1.60(OTS)
12049	16-30795	
12056	16-30699	
12081	16-30721	
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
917	16-30561	OTS
919	16-30817	Dep.(mc); $1.60(fs), $0.80(mf) JCL
NRC–	**(Canadian)**	
6922	16-30382	Can. J. Chem., 40: 1851-64(1962)
NRL–	**(Misc.)**	
5777*	16-30586	$0.75(OTS)
5805	16-31139	Dep.(mc); $2.60(fs), $0.86(mf) OTS
5844*	16-30365	
NUMEC-P–		
23	16-30483	Dep.(mc); $1.60(fs), $0.80(mf) OTS
101	16-30796	Dep.(mc); $4.60(fs), $1.43(mf) OTS
NYO–		
2310	16-30660	Dep.(mc); $3.60(fs), $1.28(mf) OTS
2669	16-30930	Dep.(mc); $9.10(fs), $3.44(mf) OTS
2680	16-31219	Dep.; $3.00(OTS)
2759	16-30211	Dep.; $3.50(OTS)
9011	16-30782	See CEND-122
9138	16-30587	Dep.; $1.50(OTS)
9203	16-30790	See MITS-48
9536	16-31067	Dep.(mc); $1.60(fs), $0.80(mf) OTS
9787	16-31274	Dep.(mc); $13.00(fs), $5.90(mf) OTS
10024	16-30447	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10094	16-31220	Dep.(mc); $2.60(fs), $1.10(mf) OTS
10133	16-31043	Phys. Rev. 128: 468-77(1962)
10240	16-30995	Dep.(mc); $2.60(fs), $1.10(mf) OTS
10554	16-30722	Dep.(mc); $4.60(fs), $1.46(mf) OTS
ORINS–		

Report No.	Abstract No.	Availability
41	16-30212	Dep.(mc); $1.50(OTS)
ORNL–		
2971(Vol.5)	16-30496	Dep.; $3.00(OTS)
2971(Vol.8)	16-31346	Dep.; $2.00(OTS)
2972	16-30797	Dep.; $1.50(OTS)
3257	16-31128	Dep.; $2.00(OTS)
3260	16-30931	Dep.; $0.50(OTS)
3297	16-30366	Dep.; $1.00(OTS)
3303	16-30798	Dep.; $3.60(fs), $1.31(mf) OTS
3313	16-30165	Dep.; $3.50(OTS)
3319	16-30678	Dep.; $2.00(OTS)
3336	16-31275	Dep.; $0.75(OTS)
ORNL-TM–		
157	16-30497	Dep.(mc); $4.60(fs), $1.61(mf) OTS
252	16-31347	Dep.(mc); $7.60(fs), $2.45(mf) OTS
366	16-30329	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ORO–		
541	16-30751	Dep.(mc); $1.10(fs), $0.80(mf) OTS
548	16-30752	Dep.(mc); $1.10(fs), $0.80(mf) OTS
566	16-30213	$2.60(fs), $0.55(mf) OTS
567	16-30753	Dep.(mc); $1.60(fs), $0.80(mf) OTS
568	16-30754	Dep.(mc); $1.10(fs), $0.80(mf) OTS
573	16-30799	Dep.(mc); $1.60(fs), $0.80(mf) OTS
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
903,751	16-31315	
903,760	16-30524	
903,784	16-30525	
903,790	16-30526	
903,803	16-30527	
903,870	16-31173	
904,140	16-31232	
904,148	16-30528	
904,165	16-30351	
904,212	16-30655	
904,214	16-30529	
904,267	16-30631	
904,331	16-31233	
904,342	16-30632	
904,366	16-30762	
904,374	16-30506	
904,416	16-30763	
904,438	16-31234	
904,507	16-30633	
904,521	16-30634	
904,569	16-30484	
904,590	16-30891	
904,608	16-31332	
904,609	16-31333	
904,610	16-31334	
904,618	16-31235	
904,679	16-30730	
904,774	16-30764	
904,827	16-30530	
904,906	16-30892	
904,921	16-31316	
904,985	16-30921	
904,988	16-30531	
905,043	16-30922	
905,068	16-30765	
905,076	16-30566	
905,238	16-30731	
905,274	16-30485	
905,346	16-31236	
905,371	16-30486	
905,387	16-30532	
905,391	16-30635	
905,401	16-30636	
905,428	16-30533	
905,464	16-30637	
905,523	16-30534	
905,559	16-30177	
905,610	16-30567	
905,645	16-31237	
905,684	16-31238	
905,696	16-30318	
905,727	16-30766	
905,882	16-31317	
905,892	16-31239	
905,920	16-30319	
905,940	16-30568	
905,946	16-31240	
906,064	16-30767	
906,068	16-30638	
906,079	16-31318	
906,096	16-31319	
906,130	16-31241	
906,304	16-31320	
906,341	16-30320	
906,406	16-30535	
906,451	16-30768	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,051,566	16-30769	
3,051,641	16-31242	
3,051,642	16-31243	
3,051,659	16-30321	
3,051,767	16-30536	
3,051,837	16-30639	
3,051,838	16-30640	
3,052,142	16-30537	
3,052,151	16-30538	
3,052,154	16-30641	
3,052,361	16-30539	
3,052,513	16-30487	
3,052,514	16-30488	
3,052,515	16-30489	
3,052,532	16-30770	
3,052,536	16-30771	
3,052,537	16-30772	
3,052,611	16-30490	
3,052,613	16-31244	
3,052,614	16-31174	
3,052,615	16-31245	
3,052,616	16-31246	
3,052,617	16-31175	
3,052,633	16-30540	
3,052,637	16-30732	
3,052,797	16-30642	
3,052,798	16-30643	
3,052,799	16-30541	
3,052,801	16-30644	
3,053,644	16-30507	
3,053,650	16-30508	
3,053,742	16-30923	
3,053,743	16-30773	
3,053,745	16-30322	
3,053,746	16-31247	
3,053,776	16-30774	
3,053,923	16-30542	
3,053,927	16-30543	
3,053,983	16-30645	
3,054,147	16-30775	
3,054,201	16-30646	
3,054,655	16-30509	
3,054,738	16-31248	
3,054,741	16-31249	
3,054,742	16-31176	
3,054,747	16-30510	
3,054,842	16-30893	
3,054,896	16-30544	
3,054,914	16-30545	
3,054,926	16-30647	
3,054,962	16-30546	

Report No.	Abstract No.	Availability
3,054,989	16-30648	
3,055,631	16-30547	
3,056,023	16-30548	
3,056,028	16-30776	
3,056,071	16-30549	
PUC–		
1962-77	16-31068	Dep.(mc); $1.10(fs), $0.80(mf) OTS
PVA–	(Non-AEC)	
1877	16-30800	
1878	16-30801	
1966	16-30802	
R–	(Misc.)	
2082	16-30377	See EURAEC-266
2109	16-30360	See EURAEC-302
2111	16-30359	See EURAEC-297
2120	16-30900	See EURAEC-326
RISÖ–	(Danish)	
36	16-30588	Dep.(mc)
RM–	(Misc.)	
61-TMP-96*	16-30659	See NP-12031
RME–		
140	16-30661	Dep.; $0.50(OTS)
SCDC–		
922	16-30713	See TID-11268
SCL-T–		
437	16-30380	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
STI-Pub.–	(International Atomic Energy Agency)	
38(p.23-37)	16-30190	See AEC-tr-5142
42(Vol.I(p.27-36)	16-30603	See AEC-tr-5368
T–	(Misc.)	
61-24	16-30793	See NP-11993
TID–		
4100(1st Rev. Index 2)	16-30515	Dep.; Free (DTI Extension)
5001(4th Rev.)	16-30171	Dep.; $4.50(OTS)
6135	16-31221	Dep.(mc); $2.60(fs), $0.83(mf) OTS
6638	16-30367	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6759	16-31000	$3.60(fs), $1.34(mf) OTS
6767	16-31348	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6875	16-30214	Dep.(mc); $1.10(fs), $0.80(mf) OTS
10821	16-30368	$1.60(fs), $0.80(mf) OTS
11120	16-31012	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11153	16-30369	Dep.(mc); $2.60(fs), $0.95(mf) OTS
11268	16-30713	Dep.(mc); $1.60(fs), $0.80(mf) OTS
11432	16-30803	Dep.(mc); $1.60(fs), $0.80(mf) OTS
11461	16-30679	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11792	16-31337	Dep.(mc); $1.60(fs), $0.80(mf) OTS
11961	16-30932	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11967	16-31069	Dep.(mc); $1.10(fs), $0.80(mf) OTS
11969	16-30330	Dep.(mc); $1.10(fs), $0.80(mf) OTS
12043	16-31070	Dep.(mc); $1.10(fs), $0.80(mf) OTS
12047	16-30910	Dep.(mc); $2.60(fs), $1.10(mf) OTS
12048	16-30370	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12089	16-30215	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12402	16-31222	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12409	16-30662	Dep.(mc); $1.60(fs), $0.80(mf) OTS
12697	16-30216	Dep.(mc); $3.60(fs), $1.37(mf) OTS
12706	16-30189	Dep.(mc); $2.60(fs), $0.92(mf) OTS
12751	16-31223	Dep.(mc); $1.60(fs), $0.80(mf) OTS
14434	16-31140	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15640	16-30804	Dep.(mc); $4.60(fs), $1.67(mf) OTS
15961	16-30448	Dep.(mc); $5.60(fs), $1.94(mf) OTS
16336	16-30663	Dep.(mc); $2.60(fs), $1.04(mf) OTS
16419	16-31013	Dep.(mc); $4.60(fs), $1.55(mf) OTS
16432	16-30449	Dep.(mc); $7.60(fs), $2.39(mf) OTS
16437	16-31071	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16457	16-30680	Dep.; $1.25(OTS)
16473	16-31072	Dep.(mc); $3.60(fs), $1.40(mf) OTS
16478	16-30723	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16479	16-30724	Dep.(mc); $1.10(fs), $0.80(mf) OTS
16489	16-30172	Dep.(mc); $23.50(fs), $10.14(mf) OTS
16495(Rev. 1)	16-31276	Dep.(mc); $5.60(fs), $1.97(mf) OTS
16496	16-30553	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16507	16-30217	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16511	16-30450	Dep.(mc); $2.60(fs), $0.86(mf) OTS
16513	16-31141	Dep.(mc); $1.10(fs), $0.80(mf) OTS
16524	16-30589	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16527	16-30805	Dep.(mc); $8.60(fs), $3.02(mf) OTS
16537	16-30218	Dep.(mc); $1.10(fs), $0.80(mf) OTS
16539	16-30554	Dep.(mc); $2.60(fs), $1.04(mf) OTS
16560	16-30911	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16562	16-30681	Dep.(mc); $5.60(fs), $2.00(mf) OTS
16569	16-30219	Dep.(mc); $2.60(fs), $1.10(mf) OTS
16573	16-30806	Dep.(mc); $2.60(fs), $0.83(mf) OTS
16574	16-30807	Dep.(mc); $3.60(fs), $1.28(mf) OTS
16577	16-30198	$2.60(fs), $0.86(mf) OTS
16578(Pts. 1&2)	16-30664	Dep.(mc); $4.60(fs), $1.49(mf) OTS
16579	16-30451	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16693	16-30371	Dep.(mc); $5.60(fs), $1.91(mf) OTS
TM–	(Misc.)	
62-7-9	16-30806	See TID-16573
TO-B–	(Non-AEC)	
61-35	16-30676	See NP-12016
TRG–	(Misc.)	
129-FR	16-31219	See NYO-2680
UAC–		
4546	16-31070	See TID-12043
4636	16-30370	See TID-12048
4669	16-30910	See TID-12047
4739	16-30215	See TID-12089
4740	16-31069	See TID-11967
4767	16-31198	See ANL-FGF-218
4796	16-30330	See TID-11969
4866	16-30932	See TID-11961
4982	16-30662	See TID-12409
5003	16-31222	See TID-12402
5046	16-30216	See TID-12697
5114	16-30189	See TID-12706
6467	16-30554	See TID-16539
6513	16-30371	See TID-16693
UCID–		
4171	16-31001	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UCLA–		
464	16-30516	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UCRL–		
5682(Suppl. I)	16-31224	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5721	16-31142	Dep.(mc); $2.60(fs), $1.04(mf) OTS
5858	16-30590	Dep.(mc); $1.60(fs), $0.83(mf) OTS
5962-T	16-30591	Dep.(mc); $2.60(fs), $0.86(mf) OTS
5975	16-30592	Dep.(mc); $3.60(fs), $1.19(mf) OTS
6012-T	16-30593	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6031	16-31277	Dep.(mc); $3.60(fs), $1.22(mf) OTS
6051	16-30665	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6072	16-30555	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6091-T	16-31338	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6114	16-31143	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6226	16-30714	Dep.(mc); $2.60(fs), $1.01(mf) OTS
6243	16-30649	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6256	16-30556	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6260	16-30715	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6264	16-31057	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6267	16-30557	Dep.(mc); $8.60(fs), $3.05(mf) OTS
6269	16-31014	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6272	16-30716	Dep.(mc); $2.60(fs), $0.92(mf) OTS
6287-T	16-31225	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6306	16-30666	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6308	16-30594	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6325	16-30595	Dep.(mc); $2.60(fs), $0.95(mf) OTS
6348	16-31329	Dep.(mc); $1.10(fs), $0.80(mf) OTS
6411	16-30558	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6686	16-31107	Phys. Rev. 128: 291-9(1962)
6705-T	16-31144	Dep.(mc); $5.60(fs), $1.94(mf) OTS

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